

HORTICULTURAL ABSTRACTS.

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Abstracts. The initialled abstract in the present number is by H. Shaw.

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Horticultural Abstracts

Vol. VI

September, 1936

No. 3

HORTICULTURE—MISCELLANEOUS.

424. ROGERS, W. S. 631.432 : 634.1/7
A soil moisture meter.
J. agric. Sci., 1935, 25 : 326-43, bibl. 32.
 After a brief reference to previous work on soil moisture the author describes the technique involved in laboratory and field tests in England and British Columbia of a moisture meter suitable for use on fallow land and in grass and irrigated orchards. The methods of using the apparatus, its limitations and possible future developments are fully discussed. In an appendix its design and method of construction are set out in detail.

425. ROGERS, W. S. 634.75 : 631.432
The relation of soil moisture to plant growth, illustrated by moisture meter experiments with strawberries.
Annu. Rep. East Malling Res. Sta. for 1935, A19, 1936, pp. 111-20, bibl. 5.
 Previous papers on the subject of this moisture meter are briefly summarized. The instrument used measures the suction force by means of a thick walled, fine grained, porous pot filled with water, buried in the soil at the required depth and connected by a copper tube to a mercury manometer or vacuum gauge. As the soil becomes drier or wetter water passes out of or back into the pot with a corresponding rise or fall of the mercury. A special device is used to prevent freezing and errors due to air dissolved in the soil water. Trials have shown that a certain lag in readings occurs owing to the thickness and density of the pot. This can be minimized by refilling fairly often with boiled water. The relation of the meter readings in the field to the "wetting" and "drying" curves obtained in the laboratory by Schofield* are not clear and there are indications that the curve given for drying conditions in the field falls below Schofield's "drying" curve. Details are given of the recording by the instrument of "drought" in 1934 and 1935 in an East Malling grass orchard. Accounts are also given of pot experiments with strawberries. The experiments were sufficient to show the point at which danger to growth of strawberries under such conditions occurs as the result of lack of moisture. This occurred at a suction force of 37 cm. Hg or a pF† of 2.7 as shown by the instrument. It is tentatively suggested that for optimum growth the soil for strawberries in pots should be kept below pF 2.7 and for strawberries in the field below pF 2.8. To obtain best results by keeping the soil of a strawberry field below pF 2.8, artificial irrigation would be necessary in a dry English summer.

426. LOOMIS, W. E. AND EWAN, L. M. 581.144.2
Hydrotropic responses of roots in soil.
Bot. Gaz., 1936, 97 : 728-43, bibl. 5.
 The hydrotropic response of roots to moisture stimuli, so generally assumed, is shown to be by no means comparable in distribution or intensity of reaction with geotropism in roots and

* The pF of water in soil. *Trans. 3rd Int. Congr. Soil Sci.*, 2, 1935, pp. 37-48.

† pF is the logarithm of the suction force in centimetres of water.

phototropism in stems. 7,763 seedlings from 29 genera and 14 families were employed, and in most of these the roots grew from wet into dry soil without deviation. When part of the root was in wet and part in dry soil, branching was most stimulated in the moist portion, but these branch roots passed normally into the dry soil, if their direction of growth lay that way. A second group of plants showed weak hydrotropic responses in their primary roots, and a third and smaller group showed a more pronounced trend, but in no case was any clear hydrotropic response apparent in the secondary roots. There is some evidence that hydrotropic response in certain *Cucurbitaceae* and *Leguminosae* is a genetic factor present in some but absent from other and closely related varieties.

427. JOHANSSON, E. 631.458
 Jordbehandling med olika kemiska medel mot jordtrötthet i plantskolor och fruktträdgårdar. (Treatment of soil with various chemicals as a remedy for exhaustion in orchard and nursery.) [English summary.]
Sverig. pomol. Fören. Årsskr., 1936, 37: 139-63, bibl. 8.

Work carried out by the author at Alnarp on behalf of the Swedish Permanent Committee for Orchard Research shows that increased growth and fruitfulness can be obtained on nursery and orchard lands that are being replanted, by the application of certain chemicals of which formalin and carbon disulphide have proved the most effective, the former being the better. Sodium chlorate and chlorinated lime were ineffective. The formalin solutions used were 0·1, 0·3, 0·5 and 0·8 formalin diluted with water to 5 litres and used on 1 sq. metre and 0·8 formalin diluted with water to 10 litres and used on 1 sq. metre. In all cases there was a marked difference in vigour and growth in favour of the treated plots, the figures being slightly higher for the larger amounts. The solutions were applied in autumn and young nursery trees planted the following spring and budded the same or the next year. In an experiment in orchard replanting begun in 1932 young trees of Cox's Pomona were planted 1·4 metres apart on ground previously treated with 0·8 litres of formalin diluted to 10 litres per sq. metre. Areas of 1·5 and 0·5 sq. metres per tree were covered. Up to the present, 1935, the improvement in yield and growth over the controls was most marked, the highest figures being for the plots where treatment had been given over the larger surface. [The Gardeners' Chronicle, September 12th, 1936, vol. 100, 3rd series, No. 2,594, p. 189, has a good abstract of this paper.]

428. SUBRAHMANYAN, V. 631.42
 Some new methods of soil analysis.
Poona agric. Coll. Mag., 1936, 28: 33-40.

A paper presented to the Agricultural Section of the 23rd session of the Indian Science Congress at Indore, January, 1936. New methods of soil analysis which have been successfully applied in the study of biochemical problems relating to soils are described. They are said to combine accuracy with rapidity and ease of handling and to be capable of adoption in routine practice.

429. LOEHWING, W. F. AND BAUGUSS, L. C. 577.17
 Plant growth effects of heteroauxin applied to soil and plants.
Science, 1936, 84: 46-7, bibl. 1.

Additions of a weak aqueous solution of β -indolyl acetic acid (heteroauxin) to the soil, in which 118 day-old potted stock seedlings, *Matthiola incana*, were growing, produced an effect by the end of the first experimental day, which reached a maximum on the sixth day following administration. Differences in stem elongation between treated and control groups of seedlings were significant, and the cotyledons of treated plants became curled. The effect was transitory, and by the tenth day stem lengths of treated and control seedlings showed no apparent differences, and the curling effect on the cotyledons had disappeared. Frequent treatment with heteroauxin of localized areas on young healthy plants produced a definite symptom complex, the speed and intensity of the responses varying with the concentration and amount of the heteroauxin solution used.

430. HOWARD, A. 631.875
The manufacture of humus by the Indore process.
Publ. R. Soc. Arts, November 22nd, 1935, pp. 44.
The conversion of horticultural wastes into humus.
The Horticulturist (publ. Norfolk County Council), 1936, 22 : 8 : 2-6.
A reply to some objections to the Indore process as applied to the improvement of tea gardens.
Pamphl. published by the author, 14 Liskeard Gardens, Blackheath, S.E.3, 1935, pp. 4.
Soil fertility and disease resistance.
Sci. J. R. Coll. Sci., 1936, 6 : 35-47.
The manufacture of humus from the waste products of tea estates.
Publ. Brit. Sci. Guild, 6 John Street, Adelphi, W.C.2, pp. 8, undated.
The rôle of insects and fungi in agriculture.
Emp. Cott. Gr. Rev., 1936, 13 : 3 : 1-7.

In all these articles and lectures Sir Albert Howard explains the method of composting discovered by him and known as the Indore method. It is claimed that this method converts vegetable and organic waste into humus at low cost and that the fertility following its continued application to the soil far exceeds that produced by chemical manures. Hitherto it has been mainly used in the tropics and sub-tropics, but the author is now endeavouring to persuade farmers in England to take it up. The ingredients required are (a) mixed vegetable wastes (fresh green materials must first be allowed to wither and woody materials should be cut into short lengths with a chaff cutter); (b) some form of animal manure for first quality humus or calcium cyanamide for second quality; (c) material for reducing excessive acidity such as earth, wood ashes, chalk, etc.; (d) water, (e) air. The material is built up in layers, 3-4 inches of vegetable waste covered by 1-2 inches of animal manure being followed by a good sprinkling of earth containing acid reducing ingredients. The heaps should be 4 ft. high when built and 2 ft. 6 in. when settled. Higher heaps than this do not allow sufficient ingress of air. If rainfall is insufficient, water is added. In 3 weeks the heap is turned, and 2 months from making it is turned again. In three months the material will have been converted into humus and be ready for application to the land. The author is convinced that pests and diseases are only able to establish themselves on plants when they are growing under unsuitable conditions and that the continued use of humus will bring about soil conditions that will enable a plant to develop a strong resistance. These claims have not been allowed to pass unchallenged and a part of most of these papers is devoted to answering objections. Experimental data on the results achieved are not produced, it being argued (1) that a replicated plot experiment would take some years to carry out and even then might not present a true picture, and (2) that the results are so evident to the eye and in the financial returns that experiment is unnecessary.

431. SHRIKHANDE, J. G. 631.875
The hot fermentation process of composting under tropical and sub-tropical conditions.

Trop. Agriculturist, 1936, 87 : 9-11, bibl. 6.

A method is described whereby the conversion of municipal waste in Ceylon, including night soil, into organic manures is conducted in such a manner that the smell, flies, loss of nitrogen and other inconveniences attendant on the usual method are avoided. The principle applied is that of hot fermentation by packing the refuse into closed brick or clay cisterns after short preliminary aerobic fermentation in the open. In trials described here the cisterns were opened after 3 months and the contents were dried and screened. The finished product crumbled to a fine powder and there was a complete absence of smell or of fly breeding at any time. There was some loss of nitrogen partly due to rain which had percolated through the walls of the cistern but the nitrogen content was always higher than that obtained by other methods. Work

in progress is (a) designing a cheap type of underground waterproof pit, (b) determining the optimum initial moisture content and time of aerobic fermentation, (c) standardizing conditions for the drying and storage of the fermented product.

432. THERON, J. J. 631.874
Green manuring. *Publ. Univ. Pretoria* (ser. 1), 13, 1936, pp. 12 English, pp. 11 Afrikaans.
The indispensability of humus to fertility in all soils is denied by the author. It is undoubtedly a desirable soil component and its presence in the soil should be preserved, which may be best done by including some years of perennial pasture cropping in the system of rotation. The practice of green manuring to replenish humus is unsuitable. On the University Farm in 12 years cropping the practice of ploughing in a legume crop grown in rotation with maize has neither increased yields profitably nor in any way helped to check the loss of humus from the soil. Green manuring may be of considerable value under irrigation and in humid areas, but in dry land cultivation in South Africa where there is a summer rainfall of 30 inches a suitable tilth can be maintained without it and it is there redundant. The cultivation of legumes as fodder crops but not for ploughing in is, however, profitable and to be recommended.

433. CURTIS, O. F. 581.144.1
Leaf temperatures and the cooling of leaves by radiation.
Plant Physiol., 1936, 11: 343-64, bibl. 13.
Hitherto little attention has been paid to the loss of heat by radiation in the infra-red, although the effects of various other factors on leaf temperatures have been much investigated. It is shown here by a number of experiments, some of which are described, that a considerable influence may be exerted on leaf temperatures by exchange of infra-red radiation between the leaf and adjacent or distant objects. There may also be loss of heat due to radiation to space. These effects are independent of the temperature of the air round the leaf, because oxygen and nitrogen of the air are almost transparent to infra-red radiation. It was demonstrated that leaf temperatures may be rapidly changed several degrees by allowing or preventing radiation to cold objects or to space. Changes in rates of air flow or light intensity also bring about such temperature changes in the leaf in direct sunlight. The presence of water in the atmosphere, either as vapour or clouds, may influence plant temperatures through its effect on infra-red radiation. Certain investigators have stated that leaves in direct sunlight may be cooler than the surrounding air. The writer questions this, having obtained clear-cut evidence that the methods for determining air temperatures were faulty and that the readings were too high.

434. ROBBINS, W. J. AND OTHERS. 581.144.2
Growth of fragments of excised root tips.
Bot. Gaz., 1936, 47 : 554-79, bibl. 13.

435. BUNCE, S. C. 674.048.4
The preservation of fencing materials.
J.S.E. agric. Coll. Wye, 1936, No. 38, pp. 150-7.
 Practical experiments at Wye on the advantages of creosote treatment of green timber for fencing are here recorded for oak, ash, black poplar, European larch and Corsican pine. Brushing on of creosote gives no penetration and cold dipping for 3 days is of little value. In poplars

and conifers cold dipping for 7-14 days gave a certain amount of penetration. Moreover, when the creosote was boiled and the timber removed immediately, penetration was not good unless the boiling was continued for 10-12 hours. Boiling for 6-8 hours and allowing the fencing to cool in the creosote gives a very good penetration and has been adopted as the normal practice at Wye.

436. HAMNER, K. C. 635.64 : 631.84 : 581.12
Effects of nitrogen supply on rates of photosynthesis and respiration in plants.
Bot. Gaz., 1936, 97 : 744-64, bibl. 7.

Tomato plants high in carbohydrates but low in nitrogen content will have a low respiratory rate compared to a plant which is higher in its nitrate content. Plants high in carbohydrate reserves have their respiratory rate increased if nitrates are supplied in abundance, other conditions remaining unchanged, and the greater the reserve, the greater and quicker will be the response. The increase in respiration always took place subsequent to the appearance of nitrates in the tops of the plants and never beforehand, no matter what the length of time after their application to the nutrient solution. The same general results were obtained with wheat. It is also shown that a relatively high photosynthetic rate may be maintained by leaves low in soluble forms of nitrogen, relatively low in chlorophyll content and relatively high in carbohydrate content of the cells. The methods and apparatus used in these experiments are described.

TREE FRUITS, DECIDUOUS.

General.

437. REINECKE, O. S. H. 632.19 : 634.1/7
Environment and its influence upon deciduous fruit production.
J. Pomol., 1936, 14 : 164-74.

The author notes the belief in a deterioration of the carrying power of S. African fruit. He considers that environment of the tree, including the four following groups of factors, are largely responsible for the falling off especially those in group 1. Group 1 Atmospheric. Group 2 Biotic viz. diseases and pests. Group 3 Edaphic viz. soil factors. Group 4 Cultivation system including rootstocks, etc. It is the atmospheric group of factors with which the author is here concerned. Comparing S. Africa with California and other fruit producing areas he finds that the period of winter dormancy is too short for many trees, and that associated with this are high temperatures during the actual dormant period which are bad both for the quantity and quality of the fruit crop. Thus the critical mean maximum temperature for the 4 winter months, May to August, appears to be about 64.5° F. at Stellenbosch. Anything over this is deleterious. Graphs show how higher temperatures have seriously affected the crop of white fleshed peaches, Japanese plums and Williams' pears shipped from Franschhoek in the period 1925-35. Considering temperatures over a 32-year period, 1903-35, at Elsenburg the author notes that there were 15 seasons with winter temperatures over 64.5° F. and 17 below that temperature limit. This would indicate, he thinks, that anyone planting there would have to expect low crop yields due to high temperature almost every other year [apart from low yields due to other factors—ED.]. He considers that growers in the past have been too prone to grow those varieties for which the highest prices are recorded on overseas markets, neglecting their ability to stand up to local environment. It is suggested that varieties which are found to bear badly under local conditions should be top grafted to others more suitable, and the attention of growers is called to the success achieved at elevations up to 2,000 ft. in the Western Cape Province and South-Western Districts in overcoming irregular growth in the spring, caused by mild winters, by spraying susceptible varieties of apples, pears, Japanese plums and prunes with oil emulsions.

438. DAHL, C. G. 634.22 : 581.145.1
Blomkaraktärernas betydelse för identifiering av plommonsorter. (The
importance of blossom characters for identifying plum varieties.)
Sverig. pomol. Fören. Årsskr., 1936, 37 : 1-52.

This paper is a summarized adaptation of one published in English in 1935,* which may be obtained from the secretarial office of the Swedish Pomological Association. In the present account the author is principally concerned with describing the blossom characteristics of plum varieties grown commercially in Sweden.

Propagation.

439. HANSEN, C. J. AND EGGERS, E. R. 631.532/5 : 634.1/8
Propagation of fruit plants.

Circ. Calif. agric. Ext. Serv., 96, 1936, pp. 52.

The bulletin gives brief descriptions, usually with an illustration, of a great number of the usual methods of vegetative propagation of deciduous and some sub-tropical fruit trees.†

Rootstocks.‡

440. AMOS, J. AND OTHERS. 634.1/2-1.541.11
Studies in incompatibility of stock and scion. I. Information accumulated during twenty years of testing fruit tree rootstocks with various scion varieties at East Malling.

Annu. Rep. East Malling Res. Sta. for 1935, A19, 1936, pp. 81-99, bibl. 11.

Almost all the rootstocks mentioned in this review were clonal material, and the effects noted are principally as between stock varieties and scion varieties. Cases of incompatibility have been most apparent among combinations of pears on certain quinces, peaches on various plums, *Prunus domestica*, *P. insititia*, and *P. cerasifera*, and among numerous combinations of plums and damsons. No very clear cases have been found among cherries on clones of Mazzard, Mahaleb or *P. Cerasus*, nor among apples on stocks of the same species. Results obtained with stocks tested for these fruits are described briefly and in some cases tabulated. Incompatibility has been manifested at all periods in the life of the trees, and, although in most combinations it became apparent through failure to form a bud union or while the trees were still growing in the nursery, with pears on some quinces it frequently appeared in a delayed form after the trees were planted in the orchard. The trials demonstrated that intervarietal as well as interspecific incompatibility will be shown in certain combinations of plums and even in the case of pears on two clonal pear stocks, while among stocks for peaches several clones of St. Julien and of Black Damas have shown striking differences in graft affinity. Among apple stocks a tentative distinction is drawn between healthy dwarfingness, with which is combined precocious and heavy cropping, and unhealthy stunting, which may be attributed to incompatibility. Dwarf Malling stocks such as No. IX are placed in the former category. The presence of a prominent bulge above the union of trees on this and some other stocks is not regarded as evidence of incompatibility, since in most of the unmistakably incompatible combinations there has been no swelling.

441. COLBY, H. L. 631.541.11/12 : 634.11
Stock-scion chemistry and the fruiting relationships in apple trees.

Plant Physiol., 1935, 10 : 483-98, bibl. 20.

The results recorded here were obtained from 6-year-old trees in the Wisconsin University Orchards, U.S.A. The stocks concerned were the dwarfing stock Malling IX and the vigorous Malling XII. On IX Whitney (a low N. tree) McIntosh, Spy and Wealthy show dwarfing

* See *H.A.*, 1936, 6 : 1 : 20.

† *Vegetative propagation of tropical and sub-tropical fruits*, issued by the Imperial Bureau of Fruit Production, East Malling, 2s., gives full information of the work done to date in various countries. Notes on rootstocks are included.

‡ See also 491, 495.

compared with the same varieties on XII. Snow and York, two extremely high N varieties, show little dwarfing on IX and only moderate vigour on XII. Roots of much dwarfed trees on IX were fully stocked with starch, fat and nitrogen contents, and the graft unions did not reduce the downward passage of carbohydrate or soluble nitrogen to the roots. Probably because of early cyclic suberization of the small roots giving a limited supply of water to the tops upward movement of reserve foods was limited in early summer in dwarf trees. This did not occur in the vigorous XII's. Snow used as an intermediate with Whitney top and IX root nearly emptied the IX trunk of starch, and increased the growth of Whitney compared with this variety direct on IX. IX used as an intermediate with Whitney top and seedling root largely retained the organic reserves in the seedling roots; with XII as intermediate a free upward flow of stored food resulted. Wealthy as an intermediate induced vigour in most varieties and resulted in shoot leaves higher in N than those of similar varieties with Jonathan intermediates. Jonathan as intermediate had a dwarfing effect and resulted in shoots higher in Fe and Mn and lower in N than shoots on Wealthy intermediates. XII itself made much rapid shoot growth after terminal growth of IX had ceased. IX root tip growth began before April 20th, and it is possible that complete root dormancy never occurred. XII root tip growth began about April 30th and vigorous growth about June 1st. In June IX root tips were peculiarly shaped, being flattened, blunt and broad. IX lacks apical dominance, the body of the tree being high in N while the shoots are low. Early starch accumulation, June 15th-July 1st, is shown by roots of fruitful dwarf trees on IX but not by the unfruitful, vigorous XII's (no trees on XII had fruited at 6 years except for a very light crop on Wealthy). Spurs and 2-year-old branches of fruitful dwarf trees on IX accumulate nitrogen and starch as the season advances, in unfruitful XII's nitrogen falls to a low level. Fruitful, inner terminal, shaded shoots of Spy on seedling stock have the high N level characteristic of fruitful Spy-on-IX shoot terminals in late July, but unfruitful, outer terminals on the same trees have the low N level of Spy-on-XII terminals at the same date. Heavy croppers (Snow and York) on seedling stock are high in N throughout root and top. [From author's summary.]

442. TUKEY, H. B. AND BRASE, K. D. 631.532/5 : 634.1/2
 Random notes on fruit tree rootstocks and plant propagation. II.*
Bull. N.Y. St. agric. Exp. Sta., 657, 1935, pp. 26, bibl. in text.

This paper records some minor observations and experimental results, which have not been published separately but which now seem to merit notice in view of their application to present problems. 1. The dormant tops of 1- and 2-year-old pears grafted on quince, including Bartlett, Beurre d'Anjou, Seckel, Kieffer, Cayuga and Clairegeau, remained uninjured by a temperature of -24° F., as did similar trees grafted on pear. The quince rootstocks, however, were all killed. Past failures with pears on quince stocks in America may be partly traced to this susceptibility to cold. 2. Tests were made of different types of quince cuttings and different times of making them, the material used being East Malling clonal stock Angers type A and common quince type B. Heel cuttings gave a higher percentage of rooting than straight cuttings. Wood collected in November before it had been exposed to winter cold and stored in sand until planted in spring gave a much higher percentage of rooting than wood collected in February or early March and similarly stored. 3. East Malling clonal apple stocks of all types tested, i.e. I-XVI (except XI and XIV) have succeeded to some degree in withstanding 8 winters and summers in New York State including a -25° F. winter and two summers of drought. A table is given showing survival at the end of this period, the losses experienced being due to all causes and therefore generally indicative of the chances of success of these stocks in this area. Types I, III, V, VII, XVI, showed no loss. 4. Two-year-old grafted Baldwins were dug up and stored horizontally in the nursery cellar at the Experiment Station, Geneva, N.Y., in the autumn of 1934, the roots being covered with moisture-retaining material. In February they were beheaded 30 inches above the crown and all buds and laterals below this point removed. They were then whip grafted with carefully matched scions of McIntosh, 8 inches long and having 5 buds, taken from trees also stored in the cellar. Before planting out time arrived, the grafts

* For I see *Bull. 649, H.A., 1935, 5 : 2 : 168.*

had had time to callus. There were no losses (except one due to accident) and subsequent union was so smooth as to be difficult to detect. Total average growth was 123.5 inches per tree and 28.7 inches per bud, a result equal to that of un-top-worked trees of similar age. 5. In western New York during a severe winter (-31° F. in 1933-4) mazzard and mahaleb rootstocks were little injured in the orchard, though many scion varieties of sweet and sour cherries were killed. In the nursery mazzard seedlings were severely injured, while mahalebs were scarcely injured. Lack of maturity due to premature defoliation from leaf spot is held to be partially to blame for this tenderness of mazzard. 6. Trees of the relatively hardy Montmorency cherry were killed back by winter cold to exactly the line of union with the more tender mazzard and mahaleb rootstocks which were uninjured. On trees which had scion rooted on one side, but not the other, there was no injury to either scion or scion root, but the scion tops on the other side of the trees were killed down to the mahaleb rootstock, the latter being uninjured. 7. The pH 3.2 of peat moss, in which roses were packed, was found either to kill or hinder the subsequent development of roots. The addition of ground limestone at the rate of $2\frac{1}{2}$ oz. (1 large handful) per bushel of granulated peat moss corrected the acidity to pH 5.7-6.0 and enabled the roses to produce good root development and satisfactory growth. 8. Application of fertilizers to apple and cherry trees in the nursery prior to digging and storing in the nursery cellar for wintering, and also to the dormant roots during storage failed to increase growth and vigour on replanting.

443. YERKES, G. E. 631.541.11 : 634.1/2
Stocks for deciduous fruits under study at experiment stations.

Stencilled Circ. U.S. Dep. Agric. Bur. Pl. Ind., 1936, pp. 20.

The paper consists of a summary of the experimental work on deciduous rootstocks in progress at the many experiment stations in U.S.A. engaged in such work. Each station is dealt with in turn. The stocks under investigation at each station are named and the total appears to be very comprehensive. The paper is useful for reference. Results are not given.

444. HATTON, R. G. 634.22-1.541.11
Plum rootstock studies. Their effect on the vigour and cropping of the scion variety.*

J. Pomol., 1936, 14 : 97-136, bibl. 10.

Notes are given on the selection of rootstocks for trial and on the difficulties arising from the attempt to limit the number of selections made from such seedling families as Myrobalan, St. Julien and Black Damas and from the incidence of the silver leaf (*Stereum purpureum*) and bacterial dieback (*Pseudomonas mors-prunorum*) diseases. A brief account is given of the comparative behaviour of identical clonal rootstocks raised by layering, by root cuttings and by wood cuttings, but the comparatively small number of trees used, i.e., 10, 10 and 9, and the incidence of disease did not allow any definite conclusions to be reached on this point. The data afforded by comparative trials of Victoria on clonal Myrobalan stock and Czar scion varieties on clonal selections of St. Julien, Black Damas, Myrobalan and Common Mussel show that a considerable degree of variability exists between these races and indicate that, although certain of the *P. cerasifera* plums may be grown in many respects fairly uniform from seed, other varieties such as St. Julien and Black Damas, grouped by Hedrick as *P. insititia*, cannot be relied on to produce anything like uniform trees. Comparative trials of plums on their own roots and worked on foreign rootstocks show that the growth of the varieties tested on Myrobalan B was greater than that of own rooted trees, Victoria proving an exception in this respect. All trees cropped as well on their own roots as on Common Mussel and on Common Plum stocks. The measurements of vigour and weight of crop from 3 successive plantings including 14 varieties and 8 chief rootstocks—from 11 to 14 years old—are presented and discussed. Significant differences in vigour as expressed by cross section of stem and total weight of tree are shown and similar comparisons are made with regard to crop and earliness of coming into bearing. The above effects on tree growth and production are considered in relation to the ideal distance of planting. Briefly, nearly all varieties on Myrobalan are the most vigorous, while trees on Common

* The first report on this subject was made in 1928 (*Ibidem*, 7 : 63-99).

Plum, Brussels and Common Mussel are usually partially dwarfed. The crops from Yellow Egg stock and Marianna are frequently outstanding in relation to the size of tree, which is normally small on these stocks. Data are presented showing that both size of fruit and date of ripening are influenced by rootstock. Mortality in trees due to disease (*Stereum purpureum* and *Pseudomonas mors-prunorum*) and delayed compatibility, and the relation thereto of variety and rootstock are considered. The development of suckers from the roots is shown to depend chiefly on the rootstock but also to be influenced in some measure by the scion. A scheme is now under way for the detailed study in the nursery of the widest possible range of combinations of rootstock and scion in order to discover incompatibilities and partialities, and investigation is now being made into possible causes of incompatibility. The following practical points for growers emerge. At the present time, if a grower wants large trees for planting 16 to 20 feet apart, Myrobalan B can be recommended for general use. Another possibility is the Brompton stock, this having the added advantage of being suitable for peaches also. By those wanting to get early crops of plum varieties which are very prone to silver leaf, Common Plum should be considered as a likely stock though incompatible with some varieties. Yellow Egg (Pershore) is another outstanding, precocious rootstock, but is as yet not obtainable true in sufficient number. The ideal stock for a precocious dwarf plum still remains to be discovered, though Marianna deserves a trial. Except for Victoria, Brussels stock, the commonest in European use to-day, cannot be recommended. [Compare the very similar results obtained under different conditions, noted in abstract No. 445 of this issue.—ED.]

445. SWARBRICK, T. 634.22-1.541.11
Plum rootstock variety trial at Long Ashton 1925-34. Progress report.
Annu. Rep. Long Ashton Res. Sta. for 1935, 1936, pp. 15-30.

Trees of 6 well-known English plum varieties have been growing at Long Ashton since 1925 on each of 7 clonally raised rootstocks. They have been under careful observation as regards growth, cropping and disease since then and results are here tabulated and discussed. The following notes are taken from the author's summary:—The difference in effects have been most noticeable. *Blaisdon Red* (stock). Trees generally vigorous, Monarch, Pond's Seedling and Victoria cropping very heavily on it. 10% of all trees died. The incidence of silver leaf not severe. A yellowing of foliage noticeable in trees. *Brussels*. Poor generally, except for Pond's Seedling which grew and cropped fairly well. Deaths 9%. Incidence of silver leaf low. *Common Mussel*. Moderately good in tree size and crop for all except Pond's Seedling. Only 2.5% died, the varieties being Blaisdon Red and Yellow Egg. Silver leaf incidence rather high. *Common Plum*. Poor without exception, though incidence of silver leaf low. *Myrobalan B*. Without exception large, vigorous trees. Cropping high except for Pond's Seedling and Victoria. Mortality low. Incidence of silver leaf very high, except in Purple Pershore, where there was none. *Yellow Egg*. Blaisdon Red and Purple Pershore grew and cropped well. Monarch, Victoria and Pond's Seedling made small trees, but for their size cropped heavily. Tree generally healthy, but with poor root hold. Incidence of silver leaf high. *St. Julien*. Poor growth and cropping except for Victoria and Pond's Seedling. Very large percentage, i.e. 21%, mortality. In general the large trees produced large crops, but this was not always the case. The varieties and rootstocks most affected by the incidence of silver leaf were Victoria, Yellow Egg and Blaisdon and Myrobalan B, St. Julien and Yellow Egg respectively. There were marked indications of recovery from silver leaf in 1933-4. [Compare the very similar results, obtained under different conditions, noted in Abstract No. 444 of this issue.—ED.]

446. BEAKBANE, A. B. AND RENWICK, M. E. 634.11-1.541.11 : 581.144.2
A preliminary report on the internal structure of the wood of No. IX rootstock in relation to scion rooting of apples.
Annu. Rep. East Malling Res. Sta. for 1935, A19, 1936, pp. 100-6, bibl. 1.

A full description is given of the technique used in the microscopic examination of the cell tissue in the wood of No. IX apple rootstock under different conditions of scion and environment.

Thus the No. IX roots and the scion roots—present in 14 cases—were compared in 25 8-10-year-old cordon trees grubbed at Wye in 1935. In addition slides were prepared of transverse sections from a root of an unworked 22-year-old No. IX tree, from roots of 2-year-old No. IX trees grafted with Lane's Prince Albert and from roots of 3-year-old No. IX trees also grafted with Lane's Prince Albert, all the latter having been grown at East Malling. The relative percentage of the medullary ray tissue, xylem parenchyma, xylem fibres and vessels of the wood of these roots was estimated. In general the No. IX roots showed vessels considerably smaller than those of the scion roots. The scion variety appears to influence the size of the rootstock vessels, though scions with larger vessels do not necessarily result in increased size of the rootstock vessels. Although structurally the roots of the No. IX group appear to show considerable variation in certain respects, they remain remarkably uniform, being characterized by a very large percentage of medullary ray tissue and a small percentage of vessels, irrespective of whether the stock is worked or not and, if worked, of the identity of the scion variety.

447. VYVYAN, M. C.

634.11-1.541.11 : 581.192

A note on the moisture content of the stems of different rootstocks.

Annu. Rep. East Malling Res. Sta. for 1935, A19, 1936, pp. 131-3, bibl. 2.

The material consisted of 8 kinds of tree, comprising all possible combinations of the scion varieties, Cox's Orange Pippin and Lane's Prince Albert and the 4 rootstocks I, II, IX and XII. Determinations of moisture were made on 4 occasions on trees planted as maidens in the spring of 1934 and on 3 occasions on trees planted as maidens in the spring of 1935. No. II stock was found consistently to have the lowest moisture value and No. I in spring the highest. It is suggested that the low moisture content in II may be connected with the low conductivity of that stock reported by Knight in 1926.

448. TYDEMAN, H. M.

634.11-1.541.11 : 632.753

The root systems of some 3-year-old trees of Lane's Prince Albert on two selected rootstocks (Malling II \times Northern Spy).

Annu. Rep. East Malling Res. Sta. for 1935, A19, 1936, pp. 107-10, bibl. 5.

Excavations, measurements and weights of 138 3-year-old Lane's Prince Albert trees on selections 779 and 789 (being seedlings of Malling II (Doucain) by Northern Spy at Merton in 1924 and now proved to be immune to woolly aphid) show that a slightly greater amount of wood growth has been made and hence a rather heavier tree than on No. II, but that the vigour is considerably less than that of trees on No. XII. The two root systems of the 779 and 789 trees are analysed and compared. That of 789 is very similar to that of No. II. No. 779 shows a considerably larger proportion of fibre in its roots than No. 789, the percentages being 94% and 50% respectively. Genetical segregation must be responsible for the production of these two extremely different root systems.

449. PEARL, R. T.

634.11-1.541.11 : 581.144.2

A note on the scion rooting of apple varieties.

J.S.E. agric. Coll. Wye, 1936, No. 38, pp. 158-62, bibl. 2.

On grubbing a small pomological garden at Wye in 1935 it was possible to examine the stumps of the trees of some 30 varieties of apple grafted on *Jaune de Metz* (No. IX) stock and planted in 1926-7 or 1928-9 with their unions well covered with soil (as was then the common practice). Soil subsidence and cultivation operations resulted, moreover, in increased burial of the unions. It had been originally intended to use the trees as single stem cordons, but for various reasons the whole row had finally been used largely for the study of varietal characteristics of the wood shoots and the trees had been allowed to grow rather freely. It was found that a considerable number of the more unmanageable trees had formed extensive and vigorous scion roots and that these were in process of superseding the rootstock. There were, on the other hand, a number of vigorous trees in which no scion rooting had occurred or in which scion roots had hardly started to form. The following showed no scion rooting:—Baumann's Reinette, Blue Pearmain,

Charles Ross, Grenadier, Stirling Castle, and Beauty of Bath, Gravenstein, Laxton's Superb and Norfolk Beauty, the last four having, moreover, shown unmanageably vigorous growth. In Gascoyne's Scarlet and Peasgood's Nonsuch also the undue vigour shown was obviously unconnected with scion rooting. Incipient scion rooting was shown by Claygate Pearmain, Lady Sudeley and Peasgood's Nonsuch. Considerable scion rooting was shown by American Mother, Bismarck, Cox's Pomona, Early Victoria, Feltham Beauty, Gascoyne's Scarlet, Gladstone, King of the Pippins, Lord Grosvenor, Ribston Pippin, Rival, Striped Beefeating. Scion rooting was predominant in Blenheim Orange, Bramley's Seedling, Wellington. The depth below ground of the union varied from 3 to 12 inches and did not appear to influence the incidence of rooting. A point of considerable potential significance is, in these grafted trees, the frequency with which a single large scion-root or a cluster of one-sided scion roots is found emerging from the tapering wedge at the base of the scion and opposite the top of the stock. The author would welcome evidence from larger plantings as to whether this is a special feature of grafted trees and if it signifies any greater propensity for scion rooting from grafted than from budded trees. The actual determination of whether a root was that of scion or stock was not always simple and great assistance was afforded by the anatomical examination of the internal tissues. [See 446 of this number.—ED.] Thanks to this method there was only one variety in which the position remained doubtful, namely King's Acre Pippin, where clear-cut anatomical differences between the stock roots and suspected scion roots could not be detected.

*Rootgrowth.**

450. ROGERS, W. S.

581.144.2 : 634.11

Some observations on the roots of fruit trees.†

Annu. Rep. East Malling Res. Sta. for 1935, A19, 1936, pp. 210-2, bibl. 7.

The author records observations made on the excavation of the complete root system of 26 Lane's Prince Albert trees, 10-11 years old, on various clonal stocks, from loam, light sand and heavy clay soils. He also shows how by means of root observation trenches in an irrigated orchard in British Columbia and at East Malling he was able to record the growth of the roots of living apple trees. It was possible to study the root hairs with a microscope and take micro-photographs. His records show that rootgrowth varies directly with soil temperature, increasing or decreasing as the temperature rises or falls, and that sufficient moisture is, together with such factors as soil consistency, fertility and aeration, a limiting factor. New roots are white and have numerous root hairs. The latter grow for 2 to 4 weeks and then shrivel up and the cortex becomes suberized and sloughs off. The root is thus left loose in its hole until secondary thickening begins. Many of the finer roots rot away entirely. At Malling the greatest root activity occurs in June, July and August. There is some, but very little, growth in winter.

Pollination.

451. HOOPER, C. H.

581.162.3 : 634.22

Plums. Notes on their pollination, order of flowering of varieties and insect visitors to the blossoms.

J.S.E. agric. Coll. Wye, 1936, No. 38, pp. 131-40, bibl. 17.

This concludes the author's most interesting series of articles on fruit pollination. In previous articles he has dealt with cherries, apples and pears.† The question of plum pollination is particularly important owing to the fact that a large number of plums are entirely self unfruitful while an even larger number do better if cross pollinated. The author gives here a list

* See also 424-6.

† Reprinted from *Trans. 3rd Int. Congr. Soil Sci.*, 1935, 1 : 249-53.

† *Ibidem*, various and *H.A.*, 1932, 2 : 3 : 219, 1933, 3 : 1 : 20, 1934, 4 : 3 : 335, 1935, 5 : 4 : 544.

of some 22 plum varieties in their approximate order of flowering, stating their relative self-fruitfulness or unfruitfulness and successful cross pollinizers as determined by trials and observations in England and Sweden. He notes the findings of different observers with regard to the exact times of blossoming of different varieties and sets them out in tabular form. From one record of 21 years at Droitwich with 27 varieties it is seen that the difference of length of time between the start of flowering of the earliest plums (Bittern and Grand Duke) and the latest (Belle de Louvain) varied between 7 and 36 days, the average length of time being 16½ days. Most of the best cropping varieties such as Pershore Yellow Egg, Victoria, Czar and others may be considered as self fruitful, but nevertheless are found to crop a little better with pollen from foreign varieties, especially when the weather at flowering time is unfavourable. Such varieties as Pond's Seedling—which is completely self unfruitful—crop well given adequate cross-pollination. Notes are given of observations made by the author at Wye and by Fox Wilson at Wisley of the insect visitors to plum blossoms.

452. NEBEL, B. R.

634.11 : 575.18

*Metaxenia in apples. V.**J. Pomol.*, 1936, 14 : 203-4, bibl. 4.

This is a brief description of further* experiments carried out in 1935. McIntosh was crossed with Wilson Red June and with Boiken and the resulting phenomena in the fruits are tabulated. The two groups of apples were extremely similar except as regards the incidence of rotting in store. After 9 months storage the apples of the Wilson Red June cross showed only slight internal browning and no rotten spots, whereas out of 41 apples from the Boiken cross 5 were completely rotten and 5 showed large rotten spots. If, as appears possible, rotting was differentially affected by the two pollens in this case, then it would also appear possible that the pollen carries into the zygote a differential rate of metabolism, which in turn indirectly causes a reflection in the metabolism of the surrounding fruit tissue, and this, though admittedly small, is detectable under accurate observation.

Growth, nutrition, etc.

453. TILLER, L. W.

634.11-2.19

*A further study of the iodine-starch reaction.**N.Z.J. Sci. Tech.*, 1936, 17 : 702-9.

In a previous paper† the value of the iodine-starch reaction as a test of maturity was examined for Cox's Orange Pippin, Jonathan, Delicious, Sturmer and Statesman. With the last three the method was found to offer little advantage over the orthodox, empirical methods in common use. In the case of the Cox's and Jonathan, however, evidence was then insufficient, and this paper deals with data which have since been acquired. For the season of 1935 a progressive change in the starch content was shown, rather less rapid in Cox than in Jonathan. A small scale determination of pit liability of Cox at high temperature, namely 60°-65° F., showed the customary lessening of the trouble as the season advances, though late picked fruit is by no means free from susceptibility. The possibility of establishing a correlation between the starch content of Cox and their bitter pit liability in cold storage is complicated by the extreme susceptibility of Cox to internal breakdown. Because of the overlapping of the susceptibility periods of bitter pit and breakdown incidence in light crop Cox apples, it is difficult to select any stage of maturity when both could be avoided. In both Cox and Jonathan apples the possession of similar starch contents by samples of fruit in different seasons does not ensure that the samples will exhibit similar storage qualities. Different standards would have to be adopted for each season. This would be commercially difficult, but in the case of heavy crop Cox apples a workable starch and maturity standard might be evolved.

* *H.A.*, 1933, 3 : 1 : 21 and 1934, 4 : 4 : 533.† *Ibidem*, 1934, 16 : 88-101, *H.A.*, 1934, 4 : 4 : 529.

Manuring, cultural practice.*

454. ROACH, W. A.

632.19 : 634.13-1.8

Leaf injection.

Annu. Rep. East Malling Res. Sta. for 1935, A19, 1936, pp. 134-6, bibl. 2.

In the spring of 1935 a small pear grown in a pot in a glass house at East Malling for breeding purposes produced foliage almost entirely lacking in green. Leaves were injected with 0.1% solution of zinc sulphate, manganese sulphate, iron tartrate and copper sulphate by holding the cut tips of each leaf under the surface of the liquid held in a suitable container and keeping them there from 4 p.m. on one day till 10 a.m. the following day. Only in the case of copper sulphate solution was any damage apparent on any leaf. Another leaf was treated with a 0.05% solution of copper sulphate for 24 hours without any apparent damage. Eleven days after the injection none of the leaves showed any damage except that treated with 0.1% copper sulphate, nor did any show any improvement except that treated with 0.1% iron tartrate. This appeared quite normal and healthy again and in great contrast to the other leaves on the tree. Ferric tartrate was accordingly injected through a hole made in the main stem of the tree and the tree foliage assumed its normal tint. During the rest of the season the tree made satisfactory growth and the fruit matured normally. The author considers that this result suggests the possibility of diagnosing and curing similar iron chlorosis deficiency diseases in a period of 3 weeks.

455. HEARMAN, J. AND OTHERS.

632.19 : 634.1/2-1.8

Tree injection, 1935 experiments. A progress report.

Annu. Rep. East Malling Res. Sta. for 1935, A19, 1936, pp. 137-41, bibl. 3.

Previous experiments with the injection of nutritional substances into fruit trees has suggested that, if the right concentration of solution were chosen—concentration being between 1.0% to 0.25%—the first appearance of leaf damage in an injected tree might be taken as an indication that the tree had then absorbed its optimum dose and that injection should then be stopped. In previous years, however, the foliage on which this warning damage had occurred had been mature, and when in 1935 the leaves remained immature for some weeks after they had expanded, probably as a result of a severe frost on May 17th, the doubt arose as to whether they would react in the same way that mature leaves had acted. This doubt proved to be well founded in the 1935 experiments. Actually the damage produced by a few injections done early in 1935 differed from that produced in previous seasons in the following respects: 1. It did not appear until at least 3 days after the injection, in contrast to an almost immediate appearance in previous years. 2. The light green plasmolysed appearance of the leaves noticeable immediately in leaves damaged by injection in previous years was not visible. 3. The spread of the damage differed. [This is shown by illustrations.—ED.] 4. All leaves appeared equally prone to damage early in 1935, whereas in previous years there was an increasing proneness to damage with increasing age. At the moment there is no satisfactory method of estimating the required dosage for a particular tree. It is suggested that, until such a method is evolved, all risk of doing damage by tree injection in summer might be avoided by waiting until the tree possesses some fully expanded mature leaves. To insure the immediate appearance of any resulting damage a small scale injection of say a 1% fertilizer solution (e.g. ammonium sulphate) might be done through a shoot or even a leaf tip. If damage appeared when the injection had proceeded for about a day and did not perceptibly increase after ceasing to inject, it should be safe to proceed with injections on a larger scale.

456. FLEMING, W. M.

631.67

A measuring device for irrigation experiments.

Sci. Agric., 1936, 16 : 619-20.

A description of a device for measuring irrigation water applied to individual rows. The apparatus consists of an open rocker box equally divided into two watertight compartments

* See also 427, 430, 432.

and fitted with a balance rod. It is supported on a delivery box. The water is projected from above into a compartment of the rocker box, which, by adjustment of the weight on the balance rod, will tilt when a given quantity of water has entered (usually half a gallon) and so discharge the water into the delivery box and thence to the furrow. Meanwhile the other compartment of the rocker box is being filled and when full it tilts back to its original position, delivering another half gallon and at the same time registering a gallon by pressing a lever on an automatic counter attached to one side of the rocker box support. The spout delivering the water should just clear the top of the rocker box (2 ft.) to prevent winds from blowing the water over the side of the box. As $6\frac{1}{2}$ Imperial gallons equal 1 cubic foot, the volume of water applied can be readily converted to cubic feet. The depth of application can be determined by dividing the volume in cubic feet by the area of the plot. The article gives complete details and measurements for construction of the apparatus.

SMALL FRUITS, VINES, NUTS.*

457. STRONG, W. J. 634.711-1.8

Results with fertilizers on the red raspberry.

Sci. Agric., 1936, 16: 424-39, bibl. 7.

The results of tests with nitrate of soda, superphosphate and sulphate of potash on the Viking red raspberry over 3 seasons at Vineland, Ontario, are reported. In the cool moist season of 1932 300 lb. nitrate of soda increased yields, but in the dry seasons of 1933 and 1934 600 lb. decreased them. No significant results were obtained by the application of superphosphates, 750 lb. and 1,200 lb. per acre, in a soil already containing a moderate supply of available phosphorus. Sulphate of potash, 480 lb. per acre, applied each year to a soil rather low in replaceable potassium, gave increased yields the last 2 years. Interactions between nitrate of soda, superphosphate and sulphate of potash in the several combinations were not apparent.

458. DOCHLERT, C. A. AND SHIVE, J. W. 634.73-1.8

Nutrition of blueberry (*Vaccinium corymbosum* L.) in sand cultures.

Soil Sci., 1936, 41: 341-50, bibl. 24.

The nutritional needs of the cultivated blueberry were investigated by means of sand cuttings and 4-salt nutrient solutions. The best solutions were low in phosphate and high in nitrogen, and nitrate nitrogen was of greater value than ammonium nitrogen. The results obtained with the cultures agree with those obtained in the field. The need for boron and manganese was shown.

459. NEGRUL, A. M. 634.8:576.312.332

Variabilität und Vererbung des Geschlechts bei der Rebe. (Variability and inheritance of sex in the vine.)

Gartenbauwiss., 1936, 10: 215-31, bibl. 38.

The author tabulates and discusses observations made on the sex of a large number of different vine crosses at various times.

460. LARGILLIER, H. J. 634.8-1.541.11/12

Étude sur le greffage. (Observations on grafting.)

Prog. agric. vitic., 1936, 106: 190-2, 204-6.

The theory that the possession of a common parent by two hybrids would react favourably on take or compatibility in grafting one upon the other is examined. The author had as material

* See also 425.

the vine collections of M. Seibel at Montboucher-Jabron with which he worked for 9 years. In an experiment 73 stock varieties were grafted with 258 scion varieties, from 25-30 examples being made of each combination. A large number of these possessed one common parent. The influence of degree of skill on the part of the various grafters was tested and found to be negligible. Each graft received identical treatment and the whole series was completed within a week. The average take obtained was 40%. With 3 combinations 100% success was achieved and at the other end of the scale 13 combinations failed entirely, while a variety of percentages intermediate between these extremes was obtained, all of which are enumerated. In no case, however, could any correlation be perceived as regards the success of the take between stock and scions possessing a common parentage. Stock influence is next discussed. It is shown (1) that a vigorous stock variety and a vigorous scion variety do not necessarily produce a vigorous combination; (2) that a vigorous stock variety may impart vigour to a weakly scion variety but on the other hand it may not; (3) a vigorous scion variety on a weakly rootstock variety will sometimes impart vigour to the rootstock, but equally often the result is unfavourable. The combination of 2 weak growing varieties was not tried experimentally. In the above cases compatibility was again uninfluenced by close consanguinity. The author suggests that compatibility may not only be a question of equality between stock and scion in quantity and intensity of sap flow and in osmotic power, but also a question of compatible chemical composition of the two saps, and he wonders whether it may not eventually be possible to determine the probability of compatibility between two subjects for grafting by standardized reactions of their sap; he draws an analogy from the operation of blood transfusion in which the necessary compatibility between the blood of patient and donor has first to be ascertained and bears no correlation to their physical appearance. The investigation is one for the laboratory, since years of field work have discovered nothing. The article concludes with the advice to vine hybridizers to concentrate on the production of phylloxera resistant hybrids which can be grown on their own roots and thus eliminate the costly practice of grafting with its uncertain results.

461. OINOUE, Y.

634.8-1.535

Grape cuttings and field of nutrition. [Japanese—English summary.]Reprinted from *J. hort. Ass. Japan*, 1935, 6: 2: 205-11, bibl. 6.

Investigations on possible relationship between mass of cuttings of grape vine (*Vitis vinifera* variety Chasselas doré) and the quantities of shoots and roots formed indicate that the two are approximately proportional only within certain limits. As the cutting mass increases, the ratio of shoots and roots to cutting mass decreases, gradually at first and then rapidly, until it ceases when the cutting mass reaches certain dimensions. The author suggests that there is a morphological limit in the cutting, outside which reserve foods are no longer available for the formation of new shoots and roots, and that there is therefore a field of nutrition in grape cuttings. [From author's summary.]

462. OINOUE, Y.

634.836.72

Utilisation d'un hybride de rotundifolia comme porte-greffe résistant au Phylloxéra. (The use of a *rotundifolia* hybrid as a stock resistant to *Phylloxera*.)Rev. *Viticult.*, 1935, 83: 289-90.

Whereas *rotundifolia*, the most *Phylloxera*-resistant species, is unsatisfactory as a stock for *Vinifera* varieties, San Rubra, a complex hybrid, one of whose parents is a *rotundifolia* hybrid, has been found to make a good union with the variety Uva di Rosa. In the first season growth is somewhat dwarfed, owing to the stock growing more slowly than the scion, but by the third year growth is sufficiently vigorous, and the vines crop satisfactorily. Good results have also been obtained using San Rubra as an intermediate between a true *rotundifolia* stock and the variety Chasselas doré, but these plants have not yet fruited.

463. OINOUE, Y. 634.8 : 581.192 : 631.55
Influence of carbohydrate and nitrogen contents in the cane of Muscat of Alexandria upon the setting of berries.

Reprinted from *J. hort. Ass. Japan*, 1935, 6 : 2 : 212-6, bibl. 4.

The vines used in the experiments described here were 7-year-old Muscat of Alexandria grafted on Berlandieri Riparia 420 A. Samples of weak, strong and very strong canes were analysed in January for carbohydrate and nitrogen. Weak canes contained less of both constituents than strong canes, but the C/N ratios were similar. Very strong canes contained more nitrogen and had a lower C/N ratio than strong ones. Weak canes set very few normal berries per bunch, strong canes set well, but very strong canes set much fewer fruits per bunch than the strong. From this the author concludes that the quantity of carbohydrate and nitrogen available in the shoot is of primary importance in the setting of normal berries, and that the C/N ratio can be taken as an index only when quantitative requirements are satisfied. The canes of two vines were also injected with either grape sugar or asparagin solutions. The former raised the carbohydrate content and the C/N ratio considerably, and the latter raised the nitrogen content and lowered the C/N ratio. With weak canes sugar injections did not increase normal berry set, but asparagin injections did, whereas with very strong canes sugar injection raised the set of berries and asparagin tended to depress it.

464. HAMOND, J. B. 634.51
Results of walnut research work at East Malling Research Station.

Annu. Rep. East Malling Res. Sta. for 1935, A19, 1936, pp. 228-31.

Seedling walnuts, which in the past have formed the vast majority of walnut trees in England, are extremely variable. The following varieties have accordingly been selected for vegetative propagation here:—Franquette, Mayette, Meylanaise, Treyve, No. 162 (Ixworth),* No. 95 (Gloucester), No. 719 (Margate), No. 589 (Dartford), No. 202 (Ipswich), "Leeds Castle" (Kent), and "Patching" (Sussex). The above leaf out late and usually escape spring frosts. *Propagation*:—(a) Rootstocks. At present seedling rootstocks of *J. regia* and *J. nigra* are used, though layered stocks are being tested. (b) Grafting. Hardwood grafting is done in February and March on 1-year-old stocks in pots under glass, scion wood of 1 or 2 years' growth being used. Greenwood grafting is done in July and August. The ties must be firm and lasting, otherwise the "callus" is liable to push the scion away from the stock and prevent a union. (c) Budding. Good results have been got experimentally by using buds of previous year's wood in May and June out of doors. *Pollination*. Some varieties, e.g. Meylanaise, bear catkins when quite young and are, therefore, additionally useful for interplanting. *Disease*. Bacterial blight can be controlled by cutting out stem lesions in the dormant season and by bordeaux spraying in the spring. Graft disease is controlled easily by formalin. *Identification*. A foliage key to the varieties mentioned is given. *Storage*. The husk should be removed when ready to fall away. The appearance of the nuts can be improved by a simple bleaching with chloride of lime and washing soda. Details of this are given. To store for winter consumption large earthenware pots are filled with alternate layers of nuts and a storage medium consisting of slightly damp coconut fibre refuse and common salt in equal parts by weight.

PLANT PROTECTION OF DECIDUOUS FRUITS.†

465. LE SUEUR, A. D. C. 632.932
The care of old trees.

J. roy. hort. Soc., 1936, 61 : 149-59.

Many old trees in forests, parks and gardens become misshapen or die prematurely through lack of attention or improper treatment. In this article the author outlines methods of wound

* Source.

† See also 585.

treatment, artificial support, and fertilizing which might help to prolong the lives and maintain the ornamental value of deciduous and some coniferous trees. [Persons interested will find a more detailed account in a book by the same author entitled *The care and repair of ornamental trees in garden, park, and street*, published by Country Life, Ltd., London, 1934, pp. 257.—ED.]

466. ASKEW, H. O., CHITTENDEN, E., AND THOMSON, R. H. K.* 634.11-2.19

The use of borax in the control of "internal cork" of apples.

J. Pomol., 1936, 14 : 227-45, bibl. 4, being *Publ. Cawthron Inst.*, 14.

In his preface Rigg notes how previous results have clearly indicated that "internal cork" is caused by a deficiency of boron in the trees. Methods of making good this deficiency are here described. Part I. *The influence of borax top dressing on the boron status of soil, fruit and leaves.* Typical orchard areas on several soil types were dug over to a depth of 3-4 inches and allowed to lie for a time to allow for settling. The surface was then raked level and the borax, powdered and mixed with sand, was broadcast at the rate of 50 lb. and 100 lb. per acre. Samples of soil were taken immediately afterwards and on three further occasions, the last some 5 months after broadcasting. During this period the rainfall (19.45 inches) was well distributed and was above the average for the district. The boron content of the soil to a depth of 18 in. was rapidly increased by the operation. The boron content of growing Jonathan and Dougherty apples was determined and found to decrease with increased size of fruit. On areas top-dressed with borax the boron content of the fruit was about the same as that of fruits reputedly free from "internal cork" and grown on healthy soil. The trial showed the ability of boron so broadcast to penetrate readily into the root zone of apple trees even on comparatively heavy soil types and to reduce thereby the incidence of "internal cork" on trees previously affected. The use of $\frac{1}{2}$ lb.-1 lb. hydrated borax per tree or 50 lb.-100 lb. per acre would appear to afford a safe control of "internal cork". Part II. *The effect of tree injection of borax solutions on the boron status of apple trees.*† Jonathan and Delicious trees in an orchard usually badly affected by "internal cork" were treated. One limb of a tree of each variety was injected with 5 grains of borax, the remainder of the tree serving as a control, the inlet holes being about 9 inches above the junction of the branch with the tree in each case. All solutions were 0.25% hydrated borax and it took 24 hours for 2 litres of the solution to be taken up. In addition amounts varying from 0.5 grams of borax were injected into the trunks, 9 inches below the crotch, of trees of both varieties in an unhealthy (i.e. affected with "internal cork") area and amounts varying from 0.15 grams into the trunks of Jonathans in a healthy orchard. In all cases the trees were in full leaf. Neither good nor ill effects were noticeable in the healthy trees. The boron content of leaves and fruits was considerably increased in all cases of both healthy and previously unhealthy trees, and, in the case of the injection being made in one limb, a considerable amount of boron was obviously able to migrate to the untreated branches. In all cases complete control of "internal cork" was given by the injection of 2.5 grams of borax into a tree. Part III. *Effect of borax sprays on the boron status of fruit and incidence of "internal cork" in apples.* In this experiment borax spray was used in 3 strengths, namely 0.1%, 0.5% and 1.0%, both with and without the addition of hydrated lime to render most of it insoluble. The spray was applied at the rate of 1 gallon per tree and in most cases only half the tree was sprayed, the rest being left as a control. Two trees were used at each concentration of spray, except that a separate set of 6 trees was sprayed all over with 1% spray. The boron content and incidence of "internal cork" from trees so treated and from control trees (or half trees) were noted and are here tabulated. The borax treatment, whether with or without lime completely controlled "internal cork". In view of the fact that absorption of boron depends on the retention of the borax sprays on the leaves for some time, it is suggested that 2 sprayings with 0.25% borax solution should be carried out at intervals of 20 days. This should ensure provision of adequate boron. There are indications that the borax might be incorporated into the lime sulphur routine spray, but practical confirmation of this is still necessary.

* Part I only.

† See also *H.A.*, 1935, 5 : 3 : 384.

467. BLACK, M. W. 632.19 : 634.1/7 : 632.951.8
Some physiological effects of oil sprays upon deciduous fruit trees.
J. Pomol., 1936, 14 : 175-202, bibl. 22.

The phenomenon of "delayed foliation", due to the winter having been too mild effectively to break the rest period of fruit trees, is a serious problem in low lying sections of S. Africa. It has long been known that the rest period can be broken by a large number of chemical, artificial agencies, but it is only comparatively recently that oil spraying has been advocated for the purpose. Previous work in America is discussed, but it is noted that previous efforts thus to use oil sprays in S. Africa have not been uniformly successful. The experiments described here were undertaken to determine more precisely under what conditions and using what materials success is likely to be obtained. The data, given here in tabular and graphic form and discussed at some length, concern apples and pears only. Preliminary results with other fruits suggest that some varieties of Japanese and European plums respond very well to oil treatment. With peaches results were not so satisfactory. The following notes are taken from the author's summary. A dormant spray of raw linseed oil emulsion (5%)* stimulated the fruit buds of Williams and Beurré Hardy pears and of White Winter Pearmain apples, and caused an earlier, more prolific and more even bloom during the 3 years of the test. Similar stimulating effects resulted during the one season of the test from the use of seal oil and two proprietary mineral oil emulsions, notably on the Ohenimuri apple and Williams pear. Oil treatment was found to result in fewer buds remaining dormant and hence in increased spur and shoot formation, in earlier and more regular growth and earlier end to the growing season. The effect of oil spraying varied with the time of spraying, variety and season. The latter half of August [i.e. the end of the dormant period.—ED.] was found to be the best time for spraying the varieties under trial. The more susceptible a variety is to "delayed foliation", the more readily was it found to respond to oil treatment. The oil effects were, moreover, less striking in a fairly normal season than in seasons in which "delayed foliation" was very noticeable. Oil sprays led to more normal blossoming and hence to considerably increased yield as well as to better storage quality in Williams pears. In addition the bearing capacity of the trees was increased by reason of increased differentiation of fruit buds on spurs and shoots.

468. FINCH, A. H. 634.521-2.19
Zinc and other mineral constituents in relation to the rosette disease of pecan trees.
J. agric. Res., 1936, 52 : 363-76, bibl. 21.

The investigations described here supply further evidence of an association between the occurrence of pecan rosette and an insufficiency of zinc for normal metabolism in the tissue. Analyses of tissues from different parts of affected and healthy trees indicated that such factors as condition of growth, location in the tree, and exposure to light and heat may act with a reduced zinc content to cause development of rosette symptoms. Thus, for example, with regard to location, it was found that in an affected tree the upper shoots which displayed the most extreme symptoms contained virtually the same percentage of zinc as did healthy, short, inside shoots and less severely affected outside shoots. On the other hand there was no evidence that any appreciable quantity of zinc may be present in non-utilizable form as happens with some other elements such as iron. Analyses of total ash, silica, magnesium, manganese and iron indicated that these may be higher in rosetted tissues than in healthy tissues with similar growth characters and position in the tree. This relationship between ash content and the occurrence of rosette symptoms ceases to apply when growths of different types or from different parts of the tree are compared, and it is thought that the increased ash content in rosetted tissue may be a result of rosette and not present in causal relationship. Where trees were treated by placing zinc in holes bored in the stems it was found that zinc moved principally and most rapidly in an upward direction, although a slower lateral and downward migration also probably took place. Girdling of a limb on a lower branch did not prevent the upward passage of zinc, and this indicates that translocation occurs in the xylem.

* Casein-ammonia stock emulsion supplied by Cape Explosive Works, Somerset West.

469. ALBEN, A. O. AND BOGGS, H. M. 634.52-2.19

*Zinc content of soils in relation to pecan rosette.**Soil Sci.*, 1936, 41 : 329-32, bibl. 5.

Of the many soils examined basic soils generally had a higher zinc content than acid soils, but pecans rosetted badly on basic soils containing considerable quantities of zinc, thus showing that the zinc was unavailable. Acid soils containing only moderate quantities of zinc grew pecan trees without rosette, indicating that this zinc was available; but acid soils which contained only small quantities of zinc, i.e. not sufficient for the trees, produced rosetted trees. A study of the zinc content as well as the chemical composition and reaction of the soil must be considered when studying the control of pecan rosette.

470. FIKRY, A. 634.2-2.19

*Water-table effects. II. Relative incidence of diseases on stone-fruit trees.**Bull. Minist. Agric. Egypt*, 154, 1936, pp. 52+plts. 43, bibl. 2.

A functional disorder of plum trees resulting in gumming and death, and accentuated by high soil water-tables is described in the first paper of this series.* Studies of a similar nature, but expanded scope, which were carried out at the Delta Barrage during the period 1931-4 are described here. Three plum varieties, Wickson (very susceptible to functional disorder), Bokra (fairly resistant) and Japanese Gold (highly resistant) were worked on Marianna rootstock (resistant) and later also on Myrobalan (susceptible). In addition, seedling peach and apricot trees and some apricots grafted on Beladi Amar were included. The site of the trials consisted of naturally terraced land which provided a low, a medium and a high plot. The soil was a permeable, rich, light loam, and the sub-soil water normal and free. Following planting in February, 1931, careful records of the incidence of functional disorder and other diseases were made monthly. The height of the water-table was likewise recorded from 14 tube-wells. The data assembled here indicate that a fluctuating sub-soil water-table influences stone fruit trees with regard to relative incidence of the functional disorder, rust, shot-hole and mildew diseases. The trees growing in the higher terrace made better general growth than the trees in the lower terrace. Disease attacks were most severe during and just after the inundation period of the Nile from August to December, and decreased from January to July, although mildew, which only attacked peaches, was prevalent in June and July. Among plums Wickson again proved very susceptible to the functional disorder, gum being exuded after a few months and deaths occurring after 2½ years. Bokra and Japanese Gold were more resistant, and peaches and apricots were less affected during the first two years, although deaths among the former were recorded after 2½ years. Shot-hole disease was most severe on peach and it also affected plums in the order Japanese Gold, Wickson, Bokra. Rust attacked all three species, but peaches were immune until about 2½ years old, after which they might be slightly attacked. During 1934 the exceptionally high Nile flood raised the water-table in the low plot above the soil surface for 12 days during September, and resulted in the death of all peach and apricot trees in the low plot and many in the medium terrace, whereas in the high plot, standing about 1 metre above the water-table, no deaths occurred. Plums were similarly more affected in the lower terraces. The author concludes that water-table effects outweigh all other factors in the incidence of functional disorder and rust, shot-hole and mildew diseases, and that land to be suitable for stone fruit cultivation should have a water-table from 100 to 125 cms. below soil surface during the period of maximum Nile flood.

471. MCKENZIE, M. A. 632.181 : 634/5

*Flood injury to trees.**Science*, 1936, 83 : 412-3.

When flood waters in Massachusetts receded during March, an attempt was made to classify the injuries done to trees. Apart from uprooting, these included complete girdling, damage from ice floes on one side of the trees, and injury from chemical and toxic materials brought

* *Bull. Minist. Agric. Egypt*, 141, 1934; *H.A.*, 1934, 4 : 4 : 525.

down by the floods. Some girdled trees may be saved by bridge-grafting, but where bark on one side only has been removed it may be sufficient to cut back any remaining loosened bark, round off the edges of the wound, and apply shellac to the exposed edges of the cambium, followed by treatment with creosote and asphalt, for sterilization and protection respectively. Most evergreens affected by crude oil cannot be salvaged as ornamental trees, but in some deciduous trees, which were dormant at the time, only small outer branches were injured, and these should be removed promptly to eliminate the possibility of the oil spreading to other parts of the tree during warm weather.

472. HOBLYN, T. N. 632.111 : 634.1/7

Spring frosts at East Malling, 1915-35.

Annu. Rep. East Malling Res. Sta. for 1935, A19, 1936, pp. 124-30, bibl. 1.

The meteorological records are carefully examined over a 21-year period for April and May and the records of minimum air temperatures are summarized. The frosts which occurred during that period are commented on and their effects upon fruit blossoms are analysed. In 6 years out of the 21 fruit plants sustained damage of economic importance as the result of unfavourable weather conditions. On most occasions the damage was done by a cold spell in the 3rd or 4th week of April, or very early in May and this period would appear to be the most critical one, especially if the season is early. Plums were affected 5 times, pears 4, black currants 5 and apples 4 times. Only on one occasion, i.e. May 17th, 1935, was frost so severe as seriously to affect every crop on the Station.

473. SPINKS, G. T. AND SWARBRICK, T. 632.111 : 634.1/7

The frost of May, 1935.

Annu. Rep. Long Ashton Res. Sta. for 1935, 1936, pp. 31-6.

The screen and grass temperatures on the night of May 16th-17th were 28° F. and 21° F. respectively. From midnight till 6 a.m. there was almost complete calm. Cold stagnant air collected over all the lower parts of the plantations and was unable to escape. Damage was very severe and general with the two following exceptions:—(1) Standard trees of Bramley, Worcester, Newton and Blenheim in a plantation on a southern slope escaped damage almost entirely. This may have been due to the height of the trees, and in addition the slope may have provided drainage for the escape of the cold air. (2) Thirty-year-old cider trees in a grass orchard, the trees either in full bloom or the pink bud stage, suffered extremely little. Reasons tentatively suggested are: the thick heads of the trees may have kept up the temperature of the orchard by checking radiation from the ground, by preventing the escape of warmer air and by obstructing the inflow of cold air. Secondly, the grass may have had some effect. Just possibly the particular varieties are less susceptible than most market varieties. Distinct varietal differences in susceptibility were noticeable. Among varieties of fruit which showed a certain amount of frost resistance in this instance were: apples Edward VII and Superb (slight); plums Czar (the fruits being well set at the time); black currants Baldwin and Westwick Choice; raspberries Preussen and Norfolk Giant; strawberries Pilnitz, Tardive de Leopold, Huxley.

474. BANE, W. A. 632.111 : 634.1/7

Investigations of frost damage to horticultural crops, with suggestions for future work.

J. Minist. Agric. Lond., 1936, 42 : 1212-8, reprinted in Annu. Rep. East Malling Res. Sta. for 1935, A19, 1936, pp. 220-4.

Following the disastrous late frost of the night of May 16th-17th, 1935, in England an investigation was started into the causes and possible prevention of similar damage in the future. As a preliminary a detailed survey was made of a very large number of farms in Kent lying on the Lower Greensand or Ragstone, the Hastings Beds or High Weald, the Swanley area and North Kent, and in addition as much information as possible was obtained from the fruit growing members of the East Malling Research Station. Altitude, aspect, shelter, manuring and cultivation, age of tree, state of blossom and varietal susceptibility are all factors which play

a part in determining frost damage and attempts were made to investigate these points. *Altitude.* Although more fruit would appear to have been lost at low than at high altitudes (altitudes 0-700 ft.) height in itself was not found to be protection against frost, but rather height in relation to surroundings. The fact that quite a number of fruit farms escaped serious damage at altitudes of less than 100 ft. can probably be attributed to the warming effect of the sea. Some of the effects of the frost are extremely difficult to explain. It would appear, however, that, where air drainage was good, the north-east wind removed the cold air from plantations and, though cold itself, was actually beneficial in this respect. The importance of air drainage was shown by the absence of lost crops and the preponderance of full crops on steep slopes. With regard to the effect of aspect and early morning sun, experience is contradictory. *Windbreaks.* In some cases windbreaks resulted in enough warm air being trapped to prevent frost damage but in others they merely prevented the wind referred to above from removing the cold air and so materially increased the damage. The evidence regarding the effects of manuring, cultivation and age of tree or damage was contradictory. Strong indications were given of varietal susceptibility, but here again several variable factors are involved including the date and duration of the blossoming period, and the differences in susceptibility of one variety at different stages in development from the bud to the fruitlet. Success of control by orchard heaters also varied. It is considered that research on methods of combating frost must necessarily be preceded by meteorological investigations on katabatic winds [winds caused by the flow of cold wind down a slope] and on more certain methods of frost prediction.

475. HOARE, A. H.

632.111 : 634.1/7

*Orchard heating.**J. Minist. Agric. Lond.*, 1936, 42 : 1218-20.

The author gives a brief account of the Harrington heater. The heater consists of a metal canister having a flame hole, covered by a lid, on the top, and 6 air holes in the side separated by a quarter of the circumference. The wicks are of asbestos rope, so that they can be used without renewal by resoaking in the fuel oil when this is renewed. They burn crude oil. The minimum number to the acre (in England) should be 50, and these, properly distributed, can raise the temperature 7-8° F. Used 60 to an acre it is possible to raise the temperature 10-12° F. They are designed to burn 11-12 hours, with a fuel capacity of 3 gallons. Their use necessitates an alarm system. This may consist of a Negretti and Zambra maximum and minimum thermometer with one wire on the left hand side set at 33° F. and the other in the mercury at the bottom. When the temperature falls to 33° F. the circuit is closed and a bell is set ringing. The heaters for 2-3 acres (50 per acre) can be lighted in $\frac{1}{2}$ - $\frac{3}{4}$ hour by a trained man. The tests of the system afforded by the 1935 May frost indicate that orchard heating by these heaters is likely to be efficient provided the organization is good, the number of heaters is not below the minimum laid down and that there is little or no wind.

476. GRASOVSKY, A.

632.183

Khamsins—a limiting factor to fruit growing in Palestine. [In Hebrew.]*Hassadeh*, 1935, 15 : 4 : 222-5.

Ways of avoiding the damage to fruit caused by the hot Khamsin wind which often blows in spring and autumn are discussed. It is pointed out that local apples, which are mostly worked on a stock that becomes active early in spring, suffer little from the winds and bear regularly, while the same varieties grafted on to Doucin or *Malus communis* and growing in close proximity come into bloom later and only bear normally good crops in years when the Khamsin has not blown. All foreign imported varieties on European stocks suffer in this way, but, if transferred to the local stock, they bloom earlier and are not affected. It is the same with all other fruit. The early flowering ones are those which bear the crops. Much can be done by the provision of dense windbreaks on the east and south-east sides of the plantation, and, if irrigation is in use, the orchards should be well watered before blossoming in spring and before the autumn Khamsins in September. These last cause leaf desiccation and premature fall. [Full translation available.]

477. SPINKS, G. T. AND CLOTHIER, G. E. 634.723-2.8
The incidence of "reversion" in seedling black currants and in clones derived from them.

Annu. Rep. Long Ashton Res. Sta. for 1935, 1936, pp. 58-66, bibl. 4.

Prior to this work there had been very little information on the incidence of reversion in seedlings and clones derived from them. The seedlings used for observations were obtained from seed of Baldwin, Boskoop, French, Seabrook and Victoria. In some cases the seed was got from selfed flowers, in others cross-fertilization was carried out. All the parents were free from reversion, unless possibly the disease was present in an invisible form. Observations were made from 1920 onwards. During the winter of 1928-9 a large trial plot was planted up with 41 clones raised from selected seedlings and with clonal plants of the commercial varieties Kent, Baldwin, Hereford Baldwin and Boskoop. The data obtained led the authors to the following conclusions: (a) That seedlings raised from apparently reversion free parent plants show no visible sign of reversion till they have reached an age at which they could have become directly infected from outside sources, thus the chance of latent reversion in parents showing itself in their seedlings is unlikely. (b) That plants propagated from some seedlings can apparently become infected with reversion as readily and rapidly as those from cuttings of commercial varieties. (c) That there is some evidence that the parentage of a variety influences its degree of susceptibility or resistance to reversion. The authors also note that in 3,000 bushes no correlation was found between the occurrence of reversion and big bud.

478. MASSEE, A. M. 634.75-2.8 : 632.753 + 632.654.2
Studies on the transmission of the strawberry virus "yellow-edge" disease by insects. II.* Aphid transmission experiments and period of infectability.

Annu. Rep. East Malling Res. Sta. for 1935, A19, 1936, pp. 171-6.

Confirmation of 1934 results was obtained in that the Delicate Strawberry Aphid (*Capitophorus fragaefolii* Cockll.) was again shown to be a vector of yellow edge, successful transmission being made from May to July. Five aphides sufficed to carry the virus from a diseased to a healthy plant and the virus symptoms were seen 7 weeks after inoculation with aphides. Direct aphid effects did not damage the plants. Attempts to transmit the virus by *Tarsonemus pallidus* were unsuccessful. Consideration is given to the correct naming of these two individuals and the author shows that the mite's correct designation by right of priority of naming is *Tarsonemus pallidus* Banks, to which *T. fragariae* can only be considered as a synonym. On the same ground the aphid should properly be called *Capitophorus fragaefolii* Cockll., *C. fragariae* being a synonym.

479. SCHNEIDERS, E. 634.8-2.8
Beobachtungen u. Untersuchungen über die Reisigkrankheit der Reben (Rebenmüdigkeit). (Observations and investigations on the "Reisig"† disease of vines ("Vine fatigue").)

Gartenbauwiss., 1935, 10 : 110-50, bibl. numerous in text.

The author gives here an account of the symptoms of a number of so-called physiological diseases of the vine which may or may not be considered due to the same agency working under different circumstances. The most easily distinguishable feature of the particular trouble in question is the appearance of a double bud within the axis of the vine shoot. The effect of the disease on the vine is seen in a general decrepitude, stunted and unfruitful growth, and lack of vitality. The evidence indicates that the causal agent is a specific pathogen which can live passively in both vine and soil until conditions unfavourable to health in the vine bring it into activity. Such are:—early and late frosts, lack of aeration in the root area, stagnant water, root rots. Faulty nutrition, uncongeniality of stock and scion and poor physical condition of soil also induce the incidence of pathological activity and should be avoided.

* For I see *J. Pomol.*, 1935, 13 : 39; *H.A.*, 1935, 5 : 2 : 214.

† "brushwood", also called "Krautern" or weedy disease.

480. BEARD, F. H. AND WORMALD, H.* 634.22-2.314-1.8
 Bacterial canker of plum trees in relation to nutrition. Experimental results in sand cultures.
Annu. Rep. East Malling Res. Sta. for 1935, A19, 1936, pp. 146-54, bibl. 9 + 1 in appendix.

Forty-two 2-year-old Victoria plum trees worked on Myrobalan A stock were planted in 18 inch pots, each filled with 140 lbs. of pure Bedfordshire silver sand. All drainage holes were sealed except one in front which was fitted with copper gauze to prevent the escape of sand. The trees were divided into 7 series, each of which was subjected to slight differences in the nutrients provided. The complete nutrient was as follows: potassium nitrate 6 gm., calcium nitrate 1·4 gm., dipotassium phosphate 1·0 gm., calcium sulphate 2·0 gm., magnesium sulphate 3·0 gm., sodium chloride 0·5 gm., ferric chloride 0·4 gm., rain water to one litre. One litre of this was diluted with nine litres of rain water and each tree received 1½ litres weekly in addition to rain water sufficient to keep the sand moist. The other nutrient treatments differed from this in the provision of more or less nitrogen, only half the potassium or no potassium, greatly increased phosphate or decreased phosphate. Trees were inoculated with *Pseudomonas mors-prunorum* and the size of the resulting cankers noted. The largest cankers developed in the greatly increased phosphate and the complete nutrient series and the smallest in the low phosphate series. Results indicate that, until further information is available regarding the effect of potash and phosphate, it would be advisable to apply heavy dressings of potash or phosphatic manures in soil where bacterial canker of plums is prevalent. It seems probable that the action of phosphate is indirect and amounts to a reduction of the availability of iron salts. This is discussed in the appendix.

481. RIKER, A. J. AND OTHERS. 634.11-2.314
 Some environmental factors influencing the development of hairy root on apple.

J. agric. Res., 1936, 52 : 715-21, bibl. in text.

1-year-old root-grafted Fameuse apple trees were grown in cans in a sandy loam with a moisture-holding capacity of about 40% under different conditions of soil temperature and soil moisture. Air temperature averaged 24° C. Inoculations with the hairy root organism, *Phytomonas rhizogenes*, were made in the scions when growth had commenced. The highest incidence of infection appeared at 24° to 28° C. and at 60% and 75% of the moisture-holding capacity of the soil. Shoot growth of the trees was vigorous between 16° and 28° C., being greatest at 20° C., and was more vigorous at 75% and 90% of the moisture-holding capacity than at 60%. The growth of hairy root bacteria at different temperatures in both solid and liquid media was also studied.

482. DU PLESSIS, S. J. 634.22-2.3
 Studies on the pear blossom blight caused by *Bacterium nectarophilum*, Doidge.

Sci. Bull. Dep. Agric. S. Afr., 141, 1935, pp. 16, bibl. 4.

This bacterial blossom blight disease is characterized by a blackening of the receptacles, which ultimately penetrates to underlying tissues, finally involving the ovaries and stems, at which stage most of the blossoms drop. In pollination experiments in a Winter Nelis orchard it was found, however, that only a relatively small percentage of the blossom drop could be ascribed to the disease, and that the major cause of dropping was failure to self-fertilize. Where Winter Nelis was artificially cross-pollinated with pollen from other varieties, fair to good percentage sets were obtained. Williams' Bon Chrétien proved the best variety for this purpose and was followed in order by Beurré Bosc, Forelle, Louise Bonne and Kieffer. Resistance to infection

* with appendix by Roach, W. A.

by the disease was also found to be increased by proper and timely cross-pollination. Inoculation studies on the over-wintering of the blight organism revealed that old spur scars from which infected fruits had fallen were not a source of primary infection, but that the organism may over-winter on old infected blossoms in the soil and on the soil itself. On the other hand, since wind was found to play no appreciable part in dissemination of the disease, it is considered unlikely that blossoms in the soil could account for infection during the early blossoming period. It is thought that the organism may also over-winter between the buds scales, but this possibility requires further investigation before a definite opinion can be formulated. Experiments with bees indicated that these are undoubtedly the most important agency for the dissemination of the disease, and that, although the hives and frames do not become contaminated, the honey, honeycomb and pollen within the hives may become contaminated and contribute towards rapid dissemination. Spraying with bordeaux mixture 4 : 4 : 50 on every alternate day during blossoming failed to produce any improvements in setting.

483. LOEWEL, E. C. 632.42 : 634.11
 Die Apfelblüte als Spritztermin. (Spraying for apple scab at blossom time.)
Gartenbauwiss., 1936, 10 : 232-46, bibl. 15.

Trials in 1934-5 by the Altenland Research group have shown that spraying at blossoming is of all sprayings the most effective against scab (*Venturia inaequalis*) and that all varieties so treated in the trials or on commercial farms suffer the operation without any damage whatever to blossoms or pollination. All the normal sprays were used. This particular stage seems so entirely apt for spraying that differences in effect of different sprays disappear. Variation of effect is seen according to the particular stage reached by the blossoms, and the best time to spray appears to be the moment when the middle blossom of a truss is in full bloom. So astonishing have been results in controlling scab of this blossom spray that a great impetus has been given to attempts to find sprays which, with an undiminished effect on scab, will be entirely harmless to bees.

484. GOODWIN, W. AND OTHERS. 632.42 : 634.11
 The control of apple scab : Allington Pippin and Newton Wonder, 1935.
J.S.E. agric. Coll. Wye, 1936, No. 38, pp. 31-7.

The Allington crop failed owing to late frost, but Newton Wonder trees showed 38.8% and 34.2% of scab affected apples when sprayed twice before and twice after blossoming with home-made bordeaux and seed oil-bordeaux emulsion respectively as compared with 92.7%, 93.8% and 91.8% affected apples from untreated trees. Results of 1933 and 1934 were confirmed that cotton-seed oil-bordeaux emulsion is as effective against scab as hydrated-lime bordeaux mixture alone, and it can, therefore, be recommended for all varieties which can normally stand bordeaux. Incidentally in the past 3 seasons it has shown no appreciable russetting of the fruit in contrast to ordinary bordeaux. It also has the following advantages : it can be applied in a heavy wash instead of a fine spray : its lower copper content will obviate or at any rate decrease spray injury : nicotine and similar contact insecticides can be incorporated.

485. DUFRENOY, J. 634.11-2.42
 Etudes épidémiologiques relatives à la tavelure du pommier. (Epidemiological studies on apple scab.)

Reprinted from *Rev. Microbiol. appl. Paris*, 1936, No. 2, pp. 20, bibl. 28.
 I. The American regional co-operative methods of assisting scab (*Venturia inaequalis*) control are described. The co-operators send three times a week early in the year to a given laboratory two or three apple leaves taken from the ground beneath the trees. These are tested for maturity of ascospores. Should these be ripe and should rain—without which the spores cannot be disseminated—be imminent, the region is warned in the course of the routine tri-weekly radio talks on orchard disease control and spraying is started. By this means it is rendered

certain that spraying does not begin until the optimum moment. II.* Horne's work on the frequencies of distribution of spores in the atmosphere is discussed and the statistical methods used are explained fully. It is mentioned that Horne showed that the greater part of the fungi whose spores were collected from the atmosphere have been proved capable by experiment of inducing rotting in apples. III. Immunity. Certain apples are much less susceptible to scab than others. There are also strains of *Venturia inaequalis* which are strongly pathogenic on some apple varieties and comparatively harmless on others. These facts are applied by the geneticists who are working on the selection of scab immune apples in U.S.A., Germany and Switzerland. IV. Conclusions. The time for treating and the materials for use in scab control in the apple districts of France are laid down.

486. UMPLEBY, E. AND SWARBRICK, T. 634.11-2.42

The incidence of canker in young cider apple trees.

Annu. Rep. Long Ashton Res. Sta. for 1935, 1936, pp. 98-103, bibl. 1.

Three years' observations show that among good cider varieties Kingston Black is outstandingly subject to canker and confirm the choice of Bulmer's Norman and Sweet Alford as suitable for use as stem builders for it and other canker susceptible varieties. There was no clear effect of rootstock on canker infection, the stocks used being Seedling Crab, Malling I (Broad leaf paradise) and Malling IX (Jaune de Metz).

487. WORMALD, H. 632.47 : 634.22

Notes on the silver leaf disease.

Annu. Rep. East Malling Res. Sta. for 1935, A19, 1936, pp. 155-7.

The rapidity with which the death of young plum trees after infection with *Stereum purpureum* can occur is described. This was clearly shown in the course of experiments in connection with which it was necessary to obtain pure cultures of the silver leaf fungus. These cultures applied to 4 maiden plum trees in November, 1934—to verify the identity of the fungus, which does not produce normal fructifications under artificial culture—had 10 months later killed 2 of the trees and seriously injured the others. The silverying in the present trial cannot have been due to meteorological conditions which were recently† suggested to be the cause of silver leaf. A stem canker with "papery bark" was observed on a young double-worked pear tree infected with *S. purpureum*.

488. OGILVIE, L. AND THOMPSON, C. R. 634.75-2.651.3

A strawberry disease resembling the American "crimp".

Annu. Rep. Long Ashton Res. Sta. for 1935, 1936, pp. 76-9, bibl. 2.

The authors' trial with Sovereign, Oberschlesien and Kooi plants in soil, into which unsterilized and sterilized soil from a diseased area in the Cheddar district had been introduced, indicate that the disease found in the Cheddar area is soil borne and may be caused by nematodes, which have been found in the heart leaves of the youngest buds and in brown areas at the bases of the petioles in diseased Kooi plants.

489. MASSEE, A. M. 634.1/7-2.6+2.7

Notes on some interesting mites and insects observed on hops and fruit trees in 1935.

Annu. Rep. East Malling Res. Sta. for 1935, A19, 1936, pp. 164-70.

The incidence of some 15 to 20 pests in 1935 is noted and the effect of the late May frost on the plum sawfly and other insects is discussed.

* Horne, A. S. Biological work on fruit. *Rept. of Food Investigation Board for 1931*, pp. 272-89, London, 1932, and *Proc. roy. Soc.*, 1935, 154-74.

† By Borggårdt, A. I., in *Bull. Sci. Res. Inst. Southern Fruit and Berry Culture, U.S.S.R.*, Part 20, pp. 7-30 (Russian-English summary).

490. SMITH, L. M. AND GOLDSMITH, E. V. 634.75 : 632.654.2
The cyclamen mite, *Tarsonemus pallidus* and its control on field strawberries.

Hilgardia, 1936, 10 : 53-94, bibl. 26.

The degeneration of strawberries in California has reached a point when a planting now becomes commercially unproductive after 2 or even 1 year, instead of lasting 4-6 years, as was formerly the case. There are probably several factors involved and one of these, which causes severe injury, is the cyclamen mite, which, living in folded leaves in the centre of the crown, produces severe distortion and dwarfing. The mite is described and illustrated. Control on established plants is unsatisfactory at present, but planting stock can be completely cleared of the pest by immersion in hot water at 110° F. for 30 minutes or better by treatment with saturated air at 110° F. for 1 hour. The temperature must not vary by more than one degree during treatment and the heating medium must be thoroughly agitated to ensure uniformity of exposure. The plants should be placed loosely in the trays or boxes to allow of maximum penetration of the hot water or vapour. Before repacking plants should be cooled and dried. Excessive drying or repacking while wet are both harmful. Strawberry plants show varietal differences in response to heat treatment.

491. CRANE, M. B., GREENSLADE, R. M. AND OTHERS. 634.11-2.753
Studies on the resistance and immunity of apples to the woolly aphid, *Eriosoma lanigerum* Haussm.*
J. Pomol., 1936, 14 : 137-63, bibl. 16.

This is an account of experiments carried on at the John Innes Institution, Merton, and at East Malling, in an attempt to produce rootstocks showing not only immunity but also other good rootstock qualities not possessed by the immune varieties hitherto used. The life cycle of *E. lanigerum* is outlined. Certain varieties are in practice completely immune to its attacks. Thus, although the aphid will feed for a time on Northern Spy, it will not reproduce there and does not cause gall formation. This and similar varieties are not attacked under natural conditions, though some may be slightly attacked in the rigorous conditions of the greenhouse. They are in this paper termed "immune". "Immune" varieties used in these investigations were Northern Spy, Winter Majetin, Irish Peach, Ben Davis, Reinette Zuccamaglio, Transparent de Croncels, Jonathan, Duchess of Oldenburg, Carrington Red, and Merton Nos. 779, 789 and 793, being seedlings derived from crossing Malling II with Northern Spy. The entomological technique used to test resistance and immunity and preliminary investigations on the underlying causes of immunity are described. A total of 3,758 seedlings has been raised and entomologically investigated, and of these 573 have proved to be immune. They were derived from susceptible \times susceptible, susceptible \times immune, immune \times immune crosses, and a few from selfing both immune and susceptible forms. If seedlings survive the very rigorous greenhouse tests of inoculation and continuous proximity for two years without becoming infested, experience has shown that they may be considered immune. They are then handed over to the pomologist to study from a pomological standpoint. A number of immune crosses, viz. Merton Nos. 778, 779, 789 and 793, has been sent to various institutions abroad for the study of their behaviour under different climatic conditions from an entomological and genetical aspect. In summarizing their results the authors come to the tentative conclusion that immunity to attack is determined by and dependent on a certain balance of genetical factors and that it is governed by a number of genes, the action of which is partly complementary and partly cumulative. A preliminary account is given of the characters of some of the immune seedlings. Photographs show clearly the distinctive appearance of immune, slightly susceptible and very susceptible seedlings submitted to infection in the greenhouse.

* For a survey of the present position with regard to this insect, see *Tech. Comm.* 8 of the Imperial Bureau of Fruit Production by R. M. Greenslade, 1936, price 2/6.

492. KEARNS, H. G. H. AND UMPLEBY, E. 632.753 : 634.11
The control of woolly aphid (*Eriosoma lanigerum* Hausm.) on nursery trees.

Annu. Rep. Long Ashton Res. Sta. for 1935, 1936, pp. 67-75, bibl. 4.

Most of the work described here was carried out on nursery stock and was divided into winter and summer treatments. Immersion on January 8th in 10% tar-oil emulsion for not less than 10 minutes did not provide a complete control, 14.5% of the trees being still infested after treatment. (Trees were allowed to drain and dry before planting afterwards and no subsequent difference in growth was noted.) A preliminary trial with 44 test and 26 control trees of immersing in hot water on March 15th at 110° F. for 30 minutes after previously washing most of the heavy clay soil off the roots resulted in 98% clean trees in mid-June with better growth than on the control trees. During June and July of 1933 a number of different varieties of standard cider nursery trees were hand-painted with a refined kerosene on the colonies of woolly aphid on the stems. The control of the aphid was satisfactory, but serious injury was caused to the trees, which would also appear to have become more prone to canker as the result of the treatment. Previous trials and, indeed, practical experience with methylated spirit have shown that its liberal application to an older stem does no harm, but that such treatment to green or terminal shoots may cause foliage scorch and check shoot growth. Spirit treatment is, therefore, best confined to older stems after the removal of green side shoots. Two spray applications of a refined white oil emulsion (1.0% oil) in conjunction with nicotine (8 fl. oz. to 100 gall.) at an interval of ten days in the summer effected a 40.6% reduction in an infestation.

493. GREENSLADE, R. M. 634.11 : 632.753
A note on the treatment of dormant nursery stock against woolly aphid.

Annu. Rep. East Malling Res. Sta. for 1935, A19, 1936, pp. 184-5.

It had been previously shown that a 10% solution of an old type of tar wash was effective as an immersion dip. In the present experiments rootstocks No. IX and No. XVI were used and the following treatments applied:—Tar oil wash at 10%, 20%, 25%, 50%; tar oil wash at 5% + 0.1% of a commercial wetting preparation; soft soap 20 lb. per 100 gall.; and 30 lb. per 100 gall.; a commercial wetting preparation at 0.1%; and the relevant controls. The stocks were immersed for 20 seconds, drained for 10 minutes, roots upwards, and planted the following day. In addition stocks were submitted both dry and watered to the effects of hydrocyanic fumes generated in amounts representing 4, 8, 16 and 32 oz. sodium cyanide per 1,000 cubic feet. [The Ministry of Agriculture's leaflet recommends 2 oz.] The stocks were kept in the fumigation box for 2½ hours and were then planted out. The only treatment which caused any permanent ill effects on after-growth, was that with 50% tar oil wash. It is concluded that much higher concentrations can with safety be used against woolly aphid than is the normal practice at Malling both in fume and liquid form.

494. ROLFE, S. W. 632.76 : 634.1/7
Three weevils of the genus *Rhynchites* injurious to fruit.

J.S.E. agric. Coll. Wye, 1936, No. 38, pp. 86-94, bibl. 12.

Descriptions are given and some account of the life history based on observations in an insectary together with notes on the occurrence, damage and control of the following pests: *Rhynchites coeruleus* De G.=the apple twig cutter, *R. germanicus* Hbst.=the strawberry leaf cutter, and *R. aequatus* L.

495. GRASOVSKY, A. 632.76 : 631.541.11
Stocks resistant to *Capnodis*. [In Hebrew.]

Boustnai, 1936, vol. 8, no. 1.

The paper is mainly concerned in discussing the resistance shown to *Capnodis* wood boring beetle by a wild almond stock found in the forests of the Safad sub-district of Palestine. Seedlings

from these trees were grown side by side with St. Julien, Myrobalan, Mahaleb, almond, apricot and peach in certain nurseries which were all badly attacked, while the Safad almond remained 100% immune. Nevertheless in other nurseries the Safad almond has shown only 98% immunity. These trees, however, had been weakened by unsuitable, i.e. heavy and moist, soil conditions. The possibilities of the Safad almond as a rootstock for Palestine are as yet unexplored, but objections are being made by nurserymen that it grows slowly and crookedly, that the internodes are so short that it is difficult to find a place for the bud when working it, and that buds do not take easily on it. The author considers, however, that provided the stock maintains its resistance to *Capnodis*, it would be worth an effort to overcome these disabilities. Two other local stocks which do well on heavy soils and have shown high resistance are two varieties of Karassia (*Prunus Karassia*) and Swedah (*Prunus domestica* var.). The latter is much used, but suckers too freely, while of the former the red sour variety has given very good results with plums and is more vigorous than the black sweet variety. [Full translation available.]

496. ANDERSON, J. A. T. 632.771 : 632.96

Gall midges (*Cecidomyiidae*) whose larvae attack fungi.

J.S.E. agric. Coll. Wye, 1936, No. 38, pp. 95-107, bibl. numerous in text.

In this article the author marshals her valuable facts as follows:—(1) Gall midge larvae known to attack fungi, (2) undetermined species whose larvae are reported to feed on fungi (these two sections forming annotated bibliographies on the subject), and (3) a list of fungi attacked by gall midge larvae.

497. STEER, W. 632.78 : 634.1

Observations on codlin moth (*Cydia pomonella* L.) in 1935.

Annu. Rep. East Malling Res. Sta. for 1935, A19, 1936, pp. 186-90, bibl. 3.

Most moths emerged during June, 1935, and laid eggs on fruits and foliage in June, July and part of August. Larvae began to attack fruit at the end of June, entering pears almost always through the eye and apples mostly at the side. Larval movements away from the fruits in search of shelter such as sack bands were about a fortnight later on pear than on apple, where they had finished by the end of September. There was no second generation in 1935. With regard to control nicotine and derris gave indifferent results, and as the result of trials it is suggested that lead arsenate be added to the second post blossom scab spray and applied 4 or 5 weeks after petal fall. The addition of lead arsenate to the petal fall scab spray is advisable where eye-entry of fruit is prevalent. [From author's summary.]

498. GREENSLADE, R. M. AND MASSEE, A. M. 634.11 : 632.768 + 632.78

Apple blossom weevil and codlin moth experiments in 1935. A progress report.*

Annu. Rep. East Malling Res. Sta. for 1935, A19, 1936, pp. 177-83.

All the banding materials used in the 1934 trials, both attractants to codlin and weevils and deterrents to weevils,† were again used and in addition trial was made of a β naphthol treatment similar to the successful one used in the U.S.A. and Australia against codlin moth. The trial was this time carried out in a 5-acre bush apple plantation consisting of some 500 trees of Bramley's Seedling, Newton Wonder and Lane's Prince Albert. The 1934 results were confirmed. None of the treatments caused any damage to the tree stems. β naphthol bands gave promising results against codlin moth larvae, but in this investigation were found to be of little value for trapping the apple blossom weevil. In addition a trial was made of the effect of various organic thiocyanates on apple stems. Bands impregnated with these substances were set in position in August and on their removal in November it was found that not only

* Being: Studies of impregnation of tree banding materials, II, for I see *Ibidem for 1934*, pp. 180-4; *H.A.*, 1935, 5 : 2 : 230.

† No treatment deterred the codlin moth.

had the treatments largely kept away insect life but also that every one of them had caused considerable damage to the stems of the trees.

499. STEER, W. 632.951.1

The use of derris root as an insecticide.

Annu. Rep. East Malling Res. Sta. for 1935, A19, 1936, pp. 225-7.

The final method of evaluating the toxic properties of derris is yet to be discovered. At present, whether bought on a rotenone content or other basis, it should be got in a fresh condition from reliable merchants. It acts as a direct and residual contact insecticide, and possibly also as a stomach poison. It is compatible with bordeaux, lime sulphur, etc., but when used thus the spray must be kept agitated to prevent the derris particles from settling out. Notes are given of its efficiency against the following pests as shown in tests at East Malling: red spider (great promise), apple sawfly, plum sawfly, aphids (not good in powder form), raspberry beetle (excellent), flea beetle (excellent as dust), apple tortrix larvae (promising).

500. JARY, S. G. 632.951.1 : 631.53

Pyrethrum.

J.S.E. agric. Coll. Wye, 1936, No. 38, pp. 59-66, bibl. 2.

The author gives a summary of the results obtained from a $\frac{1}{4}$ acre plot of pyrethrum started at Wye in 1929 and grubbed in 1935. The situation was somewhat exposed, the soil was a light calcareous loam only a few inches thick overlying chalk. *Cultivation.* Cultivation was necessarily shallow and was carried out just before the plants began vigorous growth and again after harvest by means of hand hoes with an occasional light forking. The attempt to eradicate perennial weeds usually resulted in injury to the pyrethrum plants. *Harvesting.* A satisfactory mechanical method of obtaining flowers without a large proportion of stalk has yet to be found. All the flowers want dealing with at once and this necessitates a large amount of labour. *Loss of plant.* By the end of 1935 about 30% of the original plants had disappeared, the largest individual loss occurring immediately after the largest crop obtained, i.e. in 1931-2, and being due to the rapid heating of the heaped stalks which were, on that occasion only, left on the field until the conclusion of the harvest. The only other main cause of loss of plant appeared to be invasion by perennial weeds and even more by the attempts made to eradicate them.

Drying. Air drying alone was not successful and final kiln drying was found to be essential. It was found that newly cut flowers left in bulk for more than 3-4 hours began to heat and this could only be avoided by spreading in layers not more than 3 in. deep. Twice daily the harvested flowers were spread on open textured sheets of sacking which were raised off the floor of the open packing shed by means of upturned apple boxes. If left on the floor the flowers became wet and discoloured. Drying was completed in a hop kiln. *Crop yield and pyrethrin content.* The second year, as in other experiments laid down under similar conditions, saw the largest crop. In the following year a considerable fall occurred, being probably due in part to a smaller number of flowers per plant. In the two succeeding years the yield remained about the same, and in the final year a late frost was largely responsible for a very severe falling off in yield. The ratio of dry and fresh weight remained fairly constant throughout, the loss of weight being about 75%. The pyrethrin content showed a progressive decline with age. There are indications that the effect of allowing the temperature in the drying kiln to rise to 170° F. affected the pyrethrin adversely. Actually the pyrethrin content over the whole period compared favourably with that of flowers from other parts of the world and was appreciably higher than that of many commercial samples. *Subsidiary experiments.* Six distinct types of plant were selected, differing in foliage character, size of flower, erect or procumbent growth. These were vegetatively propagated for further trial (*Ibidem*, 1935, No. 36, pp. 33-7, *H.A.*, 1935, 5 : 4 : 611). The effect of different spacing was tested and the conclusion was reached that under local conditions there was no advantage to be gained by spacing plants closer than 18 inches apart. It was possible by raising plants early in the year and planting out in May to get a small crop the same year and a full flower production the following year. It was found that among seedling plants about 70% conformed to type.

501. BOCHAROVA, S. I. 632.951
Results of the work on anabasine. [Russian-English summary.]
Agricultural science in Kasakstan, 1935, Nos. 1 and 2, pp. 87-96, 133-4.
Anabasis aphylla (*Chenopodiaceae*). "It-Sichek," is a common weed in Russia from which anabasine, a contact poison used as an insecticide, is made. It is analogous to nicotine in its chemical and toxicological properties. The 50,000 tons of raw material collected in Kasakstan produces from 2,000-2,500 tons of the preparation. Accounts are given of the following :—the anabasine base, anabasine sulphate soaps and some liquid derivatives, also of powder used in conjunction with lime, earth ashes, chalk, talc, etc.

502. KEARNS, H. G. H. AND MARTIN, H. 632.951.8
Investigation on egg-killing washes. The ovicidal properties of lauryl rhodanate.
Annu. Rep. Long Ashton Res. Sta. for 1935, 1936, pp. 49-57, bibl. 8.
The purpose of the work described was the discovery of an ovicide effective against apple aphid and sucker eggs which could safely be incorporated in the petroleum oil wash, thus giving a single combined wash and rendering the separate application of a tar distillate wash unnecessary. The authors summarize their results as follows :—1. Lauryl rhodanate, in two seasons' laboratory tests, has proved highly toxic to eggs of *Anuraphis pomi*, being more ovicidal at concentrations of the order of 0.4 per cent. than high-boiling neutral tar oil at 2.0 per cent. 2. The ovicidal efficiency of lauryl rhodanate is unimpaired by solution in petroleum oil and by emulsification with Agral S.R. or by the two-solution oleic acid method. 3. Preliminary trials have indicated that lauryl rhodanate is toxic to eggs of *Psyllia mali* at concentrations effective against aphid eggs. 4. A preliminary field trial of the combined lauryl rhodanate-petroleum wash has confirmed the general ovicidal efficiency of the wash and has demonstrated that it caused no injury to the sprayed trees.

503. KEARNS, H. G. H. AND OTHERS. 632.951/2
Combined washes. Progress report. II.
Annu. Rep. Long Ashton Res. Sta. for 1935, 1936, pp. 37-48, bibl. 6.
Owing to the very great loss of crop as the result of the May frost it was often impossible to assess the insecticidal and fungicidal efficiencies of the experimental sprays in 1935. The present report is confined to trials in which more complete results were achieved. The authors summarize as follows :—1. Further experiments confirmed previous results that a wash consisting of refined white oil (98 per cent. unsulphonated residue) at 5 per cent. concentration plus 8 per cent. lime sulphur can safely be applied to black currants just before the flowers open. A wash of similar concentration but containing a less refined oil (74 per cent. unsulphonated residue) applied at the same time caused serious injury. 2. A refined white oil at 5 per cent. concentration emulsified with sulphite lye and mixed with 3 per cent. lime sulphur was applied without damage to several apple varieties at the 'green-flower' stage. The control of apple capsid obtained by this application was not consistent. 3. Rotenone at 1.2 oz. per 100 gall. and derris root at 2.5 lb. per 100 gall. as constituents of lime sulphur-wetter combined washes, proved practically as effective as nicotine at 8 oz. per 100 gall. in the control of apple sawfly by acting as stomach poisons when applied up to 8 days before egg hatch. There was no evidence that nicotine acted as an ovicide."

504. MONTGOMERY, H. B. S. AND OTHERS. 632.42 : 632.951/2
Field trials in 1935 of the fungicidal and phytocidal properties of certain new chemical preparations. A progress report.
Annu. Rep. East Malling Res. Sta. for 1935, A19, 1936, pp. 198-203.
Tests of the fungicidal and phytocidal properties of some 20 new chemical preparations (some at different concentrations), started in 1934, were continued in 1935 on 18-year-old Cox's Orange Pippin trees in the field. Several of them proved to be unsafe for use on this variety, others proved safe but apparently had little or no effect on scab. None of those which had shown promise in 1934 proved so effective as bordeaux or lime sulphur against scab in 1935.

505. MOORE, M. H. AND MONTGOMERY, H. B. S. 632.951/2
 A field spraying trial of combined fungicidal-contact-insecticidal sprays in 1935. A progress report.

Annu. Rep. East Malling Res. Sta. for 1935, A19, 1936, pp. 191-7, bibl. 7.

Despite the May frost which ruined the fruit crop the experiments yielded the following results : “(a) Better control of scab was given by two pre-blossom sprays (coupled with post-blossom applications) of lime-sulphur, with lead arsenate and petroleum-oil emulsion, than by one. The applications were made at green-bud and pink-bud, and each caused severe leaf-burn and defoliation. (b) Three applications, at pink-bud, petal-fall and three weeks after, of lime-sulphur with certain addenda gave good control of scab and red spider, unsprayed control trees being severely attacked. The severity of attack by scab was assessed on leaves and fruit, and by red spider on leaves. The influence of rootstock was shown by scab on the leaves. (c) No consistent evidence was forthcoming that the addition of oil-emulsion or of ‘Lethalate’ standard wetting preparation to lime-sulphur affected fungicidal or acaricidal efficiency.” [Authors’ summary.]

506. FREAR, D. E. H. AND HODGKISS, W. S. 634.11-2.951.23
 Accuracy of the determination of lead and arsenic on apples.

J. agric. Res., 1936, 52 : 639-44, bibl. 8.

The accuracy of the chemical determination of lead in residues on apples by a photoelectric method, which is briefly described, is first examined, and the accuracy of the estimation as a whole of both lead and arsenic is then discussed. Data based on the analysis of 164 samples showed that the lead determination by the photoelectric method was slightly more accurate than the arsenic estimation by the Gutzeit method, even when errors due to sampling were considered.

507. DAWSEY, L. H. 632.951.8
 Determination of the less refined mineral oils on leaf surfaces after spraying.

J. agric. Res., 1936, 52 : 681-90, bibl. 8.

The problem of determination of the less refined petroleum oils in the presence of materials extracted from plant foliage by ethyl ether has been studied. Treatment of the leaf-extract residues containing petroleum with nitric acid under controlled conditions results in destruction of a definite proportion of the oil each time, and by using a predetermined correction factor the original quantity of the oil present can be estimated. Applications are suggested in the determination of oil deposit from the foliage of camphor-tree, Satsuma orange, and chrysanthemum plants following spraying with oil emulsions. The method of analysis of these sulphonatable oils in the presence of chrysanthemum leaf materials has been simplified, without loss of accuracy, by omitting the usual wax-freeing step as employed in the treatment of the camphor-tree and Satsuma orange leaf extracts. The efficiency in oil recovery in washing leaf disks taken from sprayed plants with ethyl ether has also been studied. For a limited number of washings recovery is not complete, but from 90 to 95 per cent. of the oil is removed, even when extraction is made 24 hours after the spray application. The work of other investigators is discussed in the light of the present work and the position taken that the total oil deposit is the preferable quantity to measure in the study of the insecticidal action of oils. [Author’s summary.]

508. CURRIE, G. A. 632.5
 A report on the survey of weed problems in Australia.

Pamphl. Counc. sci. industr. Res. Aust., 60, 1936, pp. 38.

The paper is an account of a broad survey initiated by the Council to determine which weed problems needed further investigation and the appropriate lines of attack. In addition details of economic significance, the present position of control and suggestions for lines of further investigations are given for 16 troublesome Australian weeds.

VEGETABLE GROWING.

509. FREELAND, R. O. 581.11/3
Effect of transpiration upon the absorption and distribution of mineral salts in plants.
Amer. J. Bot., 1936, 23 : 355-62, bibl. 14.
 Experiments, in which tomato plants, *Lycopersicon esculentum* var. Bonny Best; bean, *Phaseolus vulgaris* var. "pinto"; yellow coleus, *Coleus blumei*; and sunflower, *Helianthus annuus* var. Russian giant, were grown in different humidities and watered equally with Shive's R3S3 solution, indicate that increased absorption and movement of water in plants may appreciably increase absorption and translocation of certain minerals. Plants grown under conditions of high transpiration contained in all cases more ash, calcium, phosphorus and potassium than similar plants with low transpiration. The mineral elements were affected to different extents depending on the part of the plant as well as upon the kind of plant. In general, under conditions of high transpiration the mineral content was increased more in the leaves and roots than in the stems. In tomatoes calcium showed the greatest relative increase in the leaves with high transpiration, but in all the other plants potassium was increased more than the other elements. There seemed to be no direct correlation between mineral content and the dry weight of leaves, stems and roots.

510. KOERNICKE, M. AND LINDENBEIN, W. 631.588.1 : 631.544.5
Untersuchungen über die pflanzenphysiologischen Grundlagen der Verwendung von Elektrolicht und Wärme in Treibbeeten. (Investigations on the plant physiological basis for the use of electric light and heating in hot beds.)
Gartenbauwiss., 1936, 10 : 151-83, bibl. 22.
 In the experiments described here use was made of electric power at very economical rates not beyond the means of an ordinary German grower. The heating cable was sunk at a good depth in the soil. Lighting presented certain difficulties owing to lack of room, and success achieved with it varied with the kind of plant. Thus it was possible to get optimum conditions for growth of the Maikönig lettuce in February and March, but from November to January lack of light acted as an appreciable check. Artificial lighting at night was not sufficient to remedy this, but resulted in a suppression of head formation. As regards heating, however, the hot beds heated with electricity proved greatly superior in every particular to ordinary hot beds, especially in weight and firmness of head and tenderness of leaves. Bush bean varieties, Englische Treib and Saka, reacted to extra lighting at night both by shortening their growth period and by the help afforded to the phase of reproductive growth which meant larger crops and in particular better returns owing to earlier time of cropping.

511. NEUER, H. 664.84.34
Untersuchungen über den Einfluss der Düngung u. anderer Faktoren auf die Haltbarkeit von Dauerkohl im Winterlager. (Factors influencing the storage of cabbage.)
Gartenbauwiss., 1935, 10 : 74-109, bibl. 13.
 A great effort is being made to render Germany independent of foreign imports as regards vegetables. Among the indications, rather than proved conclusions, arising from these trials on white and red cabbage the following may be noted: 1. Manuring did not influence the dry matter content of the cabbages tested. 2. Keeping quality in winter store depended largely on variety. 3. Cabbage on which rot occurs should not be returned to store after removal of the diseased part. 4. Under the conditions of the experiment, i.e. a soil already rich in plant foods, it was found that increasing the N up to 144 kg. per ha (128 lb. per acre) increased the keeping quality. 5. Early cutting is more conducive to length of storage life than late cutting. 6. Bruising should be avoided as its effects on storage life are very serious.

512. TAYLOR, H. V. 664.583
Vegetables for pickling.
J. roy. hort. Soc., 1936, 61 : 285-9.
 Pickling is no longer a process used merely to preserve surplus crops, and the industry now requires special varieties for the purpose. The chief vegetables used are gherkins, onions, cabbage and cauliflower. Gherkins should be sown out of doors towards the end of May, in which case picking may be started 9-10 weeks later and thereafter on every second day. The fruits may be despatched direct to the factory or cured in 10·6% brine for 3-4 weeks and then stored in stronger brine till required. Careful grading is essential. The Paris gherkin, Meaux Green and Bouronne are varieties grown on the Continent. Onions for pickling are of two kinds, small-sized culinary types, which will pass through a No. 3 riddle and which will remain hard and crisp when processed, and the "Silverskin", a small white onion grown specially for pickling. In the latter case seed selection to eliminate green-striped and mis-shapen forms is important. "Silverskin" onions should be peeled at once and may be stored in brine of about 16%. Cabbages of the dark red type which will retain their colour are required by pickle manufacturers. Two such varieties are Blood Red and Nigger Head. Cauliflower is used only in mixed pickles and the manufacturer requires a head that is almost all curd and no stem. An outstanding variety is Danish Giant. When cut the cauliflowers may be stored direct in strong brine or cured like gherkins and then stored. Minor crops for pickling include walnuts, beetroot and damsons.

513. GUSTAFSON, F. G. AND STOLDT, E. 635.64 : 581.144/5
Some relations between leaf area and fruit size in tomatoes.
Plant Physiol., 1936, 11 : 445-51, bibl. 14.
 The experiments were carried out in 1933 and 1935 in Michigan. The plants were grown under a reduced light intensity, either in the field under shade or in a greenhouse, owing to the destructive effects on unprotected plants of the radiation of heat from the soil. It was found that total fruit production was most efficient when the leaf area was small. By increasing the leaf area the size of the fruit can be increased after setting, though not in proportion to the increase in food material; for example with one fruit per plant the fruit weight increased as the number of leaves per plant was raised from one to two and three, but with more than three leaves there was no further increase in fruit size. With two fruits per plant the increase in fruit size continued up to four leaves.

514. OGILVIE, L. 635.64 : 632.8
A note on the occurrence of new virus diseases of the tomato in the Bristol province.
Annu. Rep. Long Ashton Res. Sta. for 1935, 1936, pp. 104-6, bibl. 4.
 Brief notes are given of the symptoms of 2 new virus diseases differing from spotted wilt of the tomato and observed recently. Two points are stressed, namely, the similarity of the symptoms to those attributable to cold, poor cultivation, mineral deficiencies, etc., and secondly, the danger of introducing virus diseases to the tomato plant by infection from (smoking) tobacco or cigarettes.

515. SALMON, E. S. 633.79
Two new varieties of hops : "Fillpocket" and "Quality Hop".
J.S.E. agric. Coll. Wye, 1936, No. 38, pp. 38-47, bibl. 6.
 1. *Fillpocket*. This was raised in 1919 from a seedling which originated in 1909 from a plant of the American variety Oregon Cluster growing at Wye. Neither of the male parents is known. Notes are given on general and botanical characters and on its preservative value. It is found to be a heavy cropper, consistently richer than the Fuggle and it has proved satisfactory in a brewing trial. Its exact requirements are as yet unknown. 2. *Quality Hop*. This hop is also a descendant of Oregon Cluster, being actually its great granddaughter. It is found to be a hop of exceptionally high preservative power and in this character surpasses any other known

English variety. It has proved satisfactory in a brewing test and may, therefore, be recommended to growers for trial. Its exact soil requirements are not yet determined.

516. BURGESS, A. H. 633.79-1.8

The manuring of hops.

J.S.E. agric. Coll. Wye, 1936, No. 38, pp. 55-6.

In discussing the principles that should guide one in manuring hops the author notes that, though it is possible to grow heavy hop crops of good quality by the use of solely inorganic manures, such a practice tends to make the soil rather difficult to work, and hence it is preferable to use a winter dressing of some bulky manure such as farmyard manure, shoddy or rabbit waste, and supplement this with superphosphate and sulphate or muriate of potash in the spring and with sulphate of ammonia in three portions during the growing season. The presence of lime in the soil is essential. Examples of 3 specimen manurial treatments are given.

517. BURGESS, A. H. 633.79-1.56

Hop drying—air supplies and heaters.

J.S.E. agric. Coll. Wye, 1936, No. 38, pp. 57-8.

The essentials for successful drying are sufficient draught and a controllable and efficient source of heat. It is considered that the greatest single improvement which can be made to a natural draught kiln is the provision of a fan. The strength of the draught should be about 25 linear feet per minute within the body of the kiln, e.g. about 10,000 cubic feet per minute for a 20 ft. square kiln. The source of heat should be capable of raising this amount of air to about 170° F., though such a temperature is of course never used for drying. Types of heating unit include:—
(1) The old-fashioned open coal fire which demands considerable skill on the part of the operator, and care in selection of fuel. (2) The closed stove heater of which there are numerous patterns, some of which are fitted with a thermostatically controlled draught to the coal furnace. (3) The steam radiator in which the air is heated by being passed over a number of tubes through which steam is passing under pressure. The cost of drying is about the same as with stove heaters. (4) The open oil flame heater. This has come to the fore recently. Its installation is comparatively cheap, it is easy to use and it affords excellent temperature control. The essential is that the burner shall give absolutely complete combustion of the oil and a device must be fitted for cutting off the oil immediately, should the flame go out.

518. SALMON, E. S. AND WARE, W. M. 632.48 : 633.79

The *Cladosporium* disease of the hop.

J.S.E. agric. Coll. Wye, 1936, No. 38, pp. 53-4.

This disease has as yet occurred only sporadically, has caused no serious damage and has not necessitated any control measures being taken against it. The effect on the cone is, however, very like that caused by the downy mildew and this may lead the grower to pick his crop prematurely.

519. OGILVIE, L. 632.48 : 633.79

***Sclerotinia* wilt of the hop.**

Annu. Rep. Long Ashton Res. Sta. for 1935, 1936, pp. 107-9, bibl. 2.

This wilt, which was first reported on the hop in June 1935, is caused by *Sclerotinia sclerotiorum*, a fungus not previously recorded from hops. Notes are given on control by suppression of weeds, by deep cultivation, and by burning diseased material.

520. SALMON, E. S. AND WARE, W. M. 632.411 : 633.79

The downy mildew of the hop in 1935.

J.S.E. agric. Coll. Wye, 1936, No. 38, pp. 48-52.

Following the drought in July and August no attack of the mildew occurred in 1935 even in unsprayed gardens. The authors note that for the last three years the hop crop has been picked free from this disease, despite the fact that many growers have not sprayed. They

consider nevertheless that the three routine sprayings are essential and will prove their value in any normal year.

521. HARRIS, R. V. 633.79 : 632.42

The *Verticillium* wilt of hops : some facts and recommendations.

Annu. Rep. East Malling Res. Sta. for 1935, A19, 1936, pp. 158-62.

The progress of investigations into the symptoms, cause, incidence and control of this disease is recorded. Its incidence appears to be restricted to the Fuggle variety grown under certain soil conditions, which are now being examined.

522. WALTON, C. L. AND OTHERS. 632.651.3 : 635.656 + 633.491

The effect of calcium cyanamide on pea and potato "sickness".

Annu. Rep. Long Ashton Res. Sta. for 1935, 1936, pp. 91-7, bibl. 9.

Previous successes with the use of calcium cyanamide were repeated and normal crops of peas and potatoes were achieved after an application of 10 cwt. per acre. The cyst numbers on the roots of the plants were not appreciably reduced, and it is considered probable that the good results are due not to any lethal effect on the eelworms concerned but to the additional supply of nitrogen to the "sick" plants.

523. OGILVIE, L. AND BRIAN, P. W. 632.4 : 635.52 + 633.822

Progress report on vegetable diseases. VII.

Annu. Rep. Long Ashton Res. Sta. for 1935, 1936, pp. 110-7.

Lettuce. Mosaic was very prevalent on winter lettuces in the springs of 1933 to 1935. Variety trials were laid down in the Bristol area to ascertain the response of different varieties of winter hardy cabbage lettuce to mosaic. Results with 36 varieties are here tabulated. Great difference in susceptibility was apparent. It is found in practice that later plantings of winter lettuces are less likely to be severely affected by mosaic than early ones. This is thought to be due probably to the greater scarcity of aphides as the winter progresses. **Mint.** Dipping clean mint runners for 10 minutes in water at 112° F. (in practice it is necessary to heat to 115° F.) is found to control mint rust (*Puccinia Menthae*) completely and to result in much increased crops of clean mint.

524. AUSTIN, M. D. AND PITCHER, R. S. 635.8 : 632.6/7

Some diagnostic characters used in the determination of *Sciara* spp. (family *Mycetophilidae*) associated with cultivated mushrooms.*

and

PITCHER, R. S.

Observations on the larval instars of *Sciara fenestralis* Zett.†

J.S.E. agric. Coll. Wye, 1936, No. 38, pp. 78-82, bibl. 2 and 83-5, bibl. 2.

In these two articles the knowledge of the insects infesting mushroom beds is carried a step farther.

525. WALTON, C. L. 632.76 : 635.12

The control of flea beetles by means of a seed dressing. Progress report.

Annu. Rep. Long Ashton Res. Sta. for 1935, 1936, pp. 80-6, bibl. 6.

The dressing used consisted of a mixture of paradichlorobenzene and naphthalene dissolved in a kerosene. The seed is best treated with it at the rate of 2 tablespoons or 1 fluid ounce per 1 lb. seed on the day before sowing, the dressed seed being spread on sacking overnight to dry. Such treatment was generally successful in preventing or reducing flea beetle injuries. No case of seed injury was noticed. The protection was effective in all trials during the germination period and was sufficiently prolonged in most cases to allow plants to attain the "rough leaf" condition and so survive attack.

* Being Investigations on the insect and allied pests of cultivated mushrooms VII.

† Being Investigations on the insect and allied pests of cultivated mushrooms VIII.

526. JARY, S. G. AND STAPLEY, J. H. 635.8 : 632.654
 Observations upon the tyroglyphid mite (*Histiostoma rostro-serratum* Megnin*).
J.S.E. agric. Coll. Wye, 1936, No. 38, pp. 67-72, bibl. 6.
 The life cycle of this mite is described from laboratory experiments. Parthenogenetic reproduction is found to occur, the mites thus produced being males. Although it occurs in mushroom beds, there is no reason to think that it feeds on or does any injury to mushrooms.

527. BREMER, H. 635.31 : 632.452
 Zur Epidemiologie und Bekämpfung des Spargelrostes. (The epidemiology and control of asparagus rust.)
Gartenbauwiss., 1935, 10 : 51-73, bibl. 21.

The incidence of this serious disease was noted during the years 1931 to 1934-5 and attempts were made to correlate it with meteorological conditions. Field observations were unable to establish that the outbreak of asparagus rust depended at all on winter weather conditions, nor that the weather at the time of primary infection affected the severity of attack. Confirmation was obtained that warm dry summers favour the spread of the disease. One of the most important points in the epidemiology would appear to be that increasing the area under asparagus increases the danger of the incidence of asparagus rust, since young beds are most important focuses of infection. Two years' trials with a resistant Washington type proved it to be later on the average and less attacked than other types known.

FLOWER GROWING.

528. TINCKER, M. A. H. 635.9 : 631.4
 The influence of soil factors on the growth of plants.
J. roy. hort. Soc., 1936, 61 : 198-208, being *Contribution from the Wisley Laboratory*, LXXVII.

The first report on the influence of soil factors on plant growth was concerned with vegetables.† In the present paper details are given of the growth of three shrubs and several gentians and lilies on the same four soil types, arranged in close proximity in pits 3 feet deep over natural gravel, namely a clay with no chalk, a loam with no chalk, a chalk, and a sand with no chalk. The plants were neither shaded nor artificially watered. Among the shrubs, *Lonicera nitida* had grown well for 3½ years in the clay and loam, moderately in sand, and poorly in chalk. *Rhododendron obtusum* grew best in loam (pH 6.7), fairly well in clay, made about one-third the growth in sand, and died out completely within 3½ years in chalk. A similar preference was shown by *Rhododendron ponticum*. Among species of *Gentiana*, *G. acaulis* proved to be less easy to establish in clay than in the other soils; *G. sino-ornata* grew best and survived longest in the loam, dying out in chalk within 1½ years and in sand within 2½ years; *G. Cruciata* grew vigorously in loam, was dwarfed but persisted in chalk, and died out rapidly in sand; while lastly, *G. tibetica* grew well in all soils, though the survival was low in chalk. With lilies factors other than soil were found to govern success.

529. DE MOL, W. E. 551.56 : 575.2
 Untersuchungen über den Einfluss der Temperatur auf das Entstehen von Modifikationen und Mutationen bei niederländischen Hyazinthenvarietäten. (The influence of temperature on the occurrence of modifications and mutations in Dutch hyacinths.)
Gartenbauwiss., 1936, 10 : 184-214, bibl. 16.

The author's experiments in progress since 1930 are discussed. In them attempts were made to effect somatic modifications in hyacinth bulbs by artificial methods. Eight different treatments

* Investigations on the insect and allied pests of cultivated mushrooms VI.

† Derbyshire, F. V. and Tincker, M. A. H., *Ibidem*, 1934, 59 : 251-73; *H.A.*, 1934, 4 : 3 : 399.

were tested. Somatic modification, shown by both loss and gain of certain elementary factors, was only achieved in several individual cases after submission of bulbs to the following treatment:—The bulbs were dug when almost ripe (i.e. when the top had almost completely withered and the roots died away) on July 4th. They were dried at 75° F. from July 4th to 9th. They were then kept in the cold at 38° F.-41° F. from July 9th to October 26th. From October 26th to November 28th they were submitted to a temperature of 74° F.-78° F. From November 28th to December 24th they were again cooled at 40° F.-50° F. From December 24th to January 26th the temperature was kept at 74° F.-78° F., from January 26th to February 16th at 40° F.-50° F. and from February 16th to May 6th at 60° F.-65° F., when the bulbs were replanted. The modifications became noticeable during the cell division processes in blossom formation.

530. ANON.

635.944 : 632.4

Tulip diseases.*J. roy. hort. Soc., 1936, 61 : 352-3.*

Two fungus diseases of tulips are briefly described. Grey bulb-rot, caused by *Sclerotium Tuliparum*, is the more serious. Single infected plants should be removed together with the soil surrounding the roots, but, if a whole bed is affected, the only cure is to avoid planting any tulips in the soil for the next four years. Fire, caused by *Botrytis Tulipae*, is most prevalent when early tulips are exposed to frosts, storms and a moist environment. Delaying planting until November 10th or even later, deep planting, an open site to permit rapid drying of the foliage, and the removal of fallen petals or other plant debris will help to control the disease.

531. GREEN, D. E.

635.939.516-2.452

Antirrhinum rust. II. The results of spraying and dusting with fungicides.*J. roy. hort. Soc., 1936, 61 : 64-76, bibl. in text, being Contribution from the Wisley Laboratory, LXXV.*

Experiments were carried out at Wisley in 1935 to determine whether antirrhinum rust, *Puccinia Antirrhini*, might be controlled by the use of fungicidal sprays or dusts. The variety used was Malmaison, which had shown great susceptibility in infection tests. Treatments consisted of 9 sprays, 3 dusts, and an untreated control, making 13 plots, all of which were replicated 8 times. Spray applications were made from one to eight times at fortnightly intervals, all plots being sprayed first on July 1st-2nd, and thereafter one plot for each treatment being left untreated after each fortnightly interval. The results indicate that only the two copper-containing sprays, bordeaux mixture, 4 : 6 : 50, and burgundy mixture, 4 : 5 : 50, exerted any appreciable control, and of these the latter proved markedly superior where applications were made 3, 4 or 5 times, and slightly superior where applications were made 6, 7 or 8 times. In either case, however, it was necessary to spray for at least 6 times for control to be at all satisfactory, and even then it was by no means perfect. Burgundy, unlike bordeaux, does not discolour the foliage, and neither spray injures the flowers. The failure of sulphur treatments is contrary to experience in the U.S.A., and it is thought that the reason for this lies in the lower summer temperatures prevailing in England.

532. MUENSCHER, W. C.

635.939.9 : 581.142

Seed germination in lobelia, with special reference to the influence of light on***Lobelia inflata*.***J. agric. Res., 1935, 52 : 627-31, bibl. in text.*

Laboratory and field experiments demonstrated that light is essential for the germination of seeds of *Lobelia inflata* L., the Indian tobacco. Good germination was obtained when seeds were sown on the soil surface, but there was almost complete failure when the seeds were covered with 1 cm. of soil. Further tests showed that two other species, *L. cardinalis* and *L. siphilitica*, also require light for germination, but that seeds of *L. tenuior*, *L. erinus* and *L. dortmanna* germinate equally well in light or darkness. Seeds of *L. inflata* retain their viability for at least 5 years in dry storage and will germinate in all years, but it was found that those of *L. cardinalis*

and *L. siphilitica* did not germinate one year after harvest, and gave the best results after 4 years, thus suggesting the development of a secondary dormancy brought about by dry storage conditions. Seeds of *L. dortmanna*, an aquatic plant, retained their viability for at least 4 months when kept in water at 1° to 3° C., but lost their viability when dried.

533. NIGHTINGALE, G. T. AND FARNHAM, R. B. 635.937.36 : 631.8
Effects of nutrient concentration on anatomy, metabolism and bud abscission of sweet pea.

Bot. Gaz., 1936, 97 : 477-517, bibl. 35.

Sweet peas grown under glass commercially in a fertile soil rich in organic matter grow strongly but during winter show a high percentage of abscission of the buds, occurring chiefly on plants that grow vigorously, are comparatively succulent, and have thin dark leaves of relatively large area. Such plants were shown to be invariably high in percentage concentration of amino-acids and proteins but low in reserve carbohydrates. Successful growers use soil rich in nutrients including nitrate and watered only sparingly in winter. The plants under this treatment were found to be not high in elaborated forms of nitrogen such as amino-acid and proteins, to contain a relatively high percentage of carbohydrates and to show little abscission. On the assumption that a chief effect of low soil moisture is an increased concentration of salts in the soil, tests in sand culture were made and form the subject of this paper. In these tests the dilute nutrient solutions produced abscission, while the more concentrated ones, in which the plants grew less vigorously, did not do so to any extent. The low concentrations produced plants high in proportion of young active cells containing dense protoplasm; carbohydrates were low and organic nitrogen high, tissues differentiated and matured slowly, and elaborated nitrogen was largely in the form of amide and amino nitrogen. Nitrate was abundant. Abscission occurred through the persistence at the junction of pedicel and peduncle of tiers of cells which did not mature and remained meristematic in appearance. Subsequently the middle lamellae of one or more tiers became gelatinized and the bud abscissed. The high concentration produced plants with but few cells of dense protoplasm contents; tissues differentiated and grew rapidly, carbohydrates were high and organic nitrogen low, elaborated nitrogen was in the form of complex proteins. Nitrate was abundant. The effect of the high concentration of nutrient salts was that of low protein nutrition, since only young cells containing abundant protoplasm can synthesize proteins from nitrate. This limited reduction and assimilation of nitrate may account in part for the marked accumulation of carbohydrates. In a discussion of soil moisture content and salt concentrations in the soil it is pointed out that salt concentration of the soil solution may bring about early maturation of the tissues long before wilting point is reached. The effects may be severe in fruit trees and certain other perennials which mainly conduct their initial phases of nitrate assimilation and protein synthesis in their fine succulent rootlets. These rootlets quickly lose ability to manufacture protein in the presence of a relatively concentrated solution of salts, though the power to absorb nitrate is not limited.

534. RICKETT, H. W. 587.34
Forms of *Crataegus pruinosa*.

Bot. Gaz., 1936, 97 : 780-93, bibl. 46.

Three new forms of *Crataegus pruinosa* from the neighbourhood of Columbia, U.S.A. are described and given sub-specific names. The difficulty of the genus from a taxonomic point of view is discussed.

535. MAURER, E. AND STORCK, A. 635.939.183
Untersuchungen zur Züchtung einer giftfreien Primel vom "Obconica"—Typus. (Attempts to raise a non-poisonous primula of the "obconica" type.)

Gartenbauwiss., 1935, 10 : 1-50, bibl. 68.

A detailed account is presented of the genetical make up and of the botanical, chemical and genetical research made up to date on the "obconica" type of primula and the possibility

of producing a hybrid which, possessing equal floral qualities, will not possess its skin-poisoning properties. Hybridization by Arends (back crossed hybrids of *[P. sinolisteri] × P. obc.] × P. sinolisteri*) has now resulted in some plants in which the poisonous element (primin) is absent. It is thought that these may form a bridge towards the attainment of a non-poisonous "obconica".

536. SLOCOK, O. C. A. 635.939.124
Rhododendrons.

J. roy. hort. Soc., 1936, 61 : 317-32.

An account is given of sites for, and the planting of, rhododendrons in England. Brief descriptions are also given of a number of species and hybrid varieties, and notes are supplied on diseases and pests.

537. MOMOT, K. G. 585.722
The aloe. [Russian-English summary.]

Sovyaishksia subtropiki, 1936, 6 : 60-3.

Notes are given on the chemico-pharmaceutical study of 24 species of aloe growing at the acclimatization station at Sukhum. *Aloe striatula* Haw., which has been naturalized along the Black Sea coast of the Caucasus, proved the most satisfactory. It is easily propagated by cuttings planted directly into their permanent positions. The yield of aloe, obtained by extraction from the leaves, is 2 per cent. of the raw weight. *Aloe arborescens*, though promising, is more exacting as to temperature.

538. PRESLEY, J. T. 633.913 : 612.014.44
Rubber content of goldenrod leaves affected by light.

Science, 1936, 88 : 436, bibl. 2.

The leaves of many wild species of *Solidago* (goldenrod) contain rubber. The content increases with maturity, but is greatly reduced as soon as the leaves die, whether they remain on the plant or are detached. The effect of light on this rapid decline was studied by exposing leaf samples in red, blue, green and clear cellophane envelopes, while check samples were kept in black paper envelopes. Analyses showed that considerable losses of rubber occurred within a short period in leaves exposed in red, blue, green and clear envelopes, being greatest in the last-named, whereas the samples kept in black envelopes tended, if anything, to gain in rubber content. This is taken to indicate that light is undoubtedly a factor in reducing the rubber content of goldenrod leaves after harvesting.

CITRUS AND SUB-TROPICALS.

539. JOACHIM, A. W. R. 634.3
Some notes on the citrus industry of Palestine.

Trop. Agriculturist, 1936, 88 : 323-31, bibl. 6.

The soils suitable for citrus in Palestine are well drained, red soils, varying in texture from light sands to fairly heavy loams. The value of the soils lies in their physical properties, since compared with other local soils they are poor in potash, phosphoric acid, nitrogen and organic matter. Manuring is considered essential for citrus, though the soils are adequate to support wheat. There are also many loams of a richer nature on which citrus is grown to a lesser extent and other soils which are quite unsuitable, chiefly owing either to lack of drainage or to shallowness. Orange varieties grown are Shamouti or Jaffa, Beledi—the round seedy "native" type—and Valencia Late. Marsh's Seedless is the chief grapefruit grown. Rootstocks are sour orange and sweet lime, the latter being gradually discarded on account of its liability to gummosis. An instance of stock influence apparent on Lord Melchett's estate on the Lake of

Tiberias is quoted. On a heavy loam, not quite suitable for oranges, the trees on sweet lime were showing gummosis and dieback and fruiting only moderately, those on sour orange though younger were bigger, bearing more heavily and disease free. High budding at 18-24 in. has given place to lower budding 8-10 in. above the ground. High planting to minimize danger from gummosis is preferred. Machine cultivation is done on the larger and more progressive groves. Lupins form the principal green manure for ploughing in. Pruning is reduced to a minimum with the idea of maintaining a good head of foliage. Irrigation is necessary with water obtained from wells 30-130 ft. deep and from pipe lines which are sunk to far below the water table, sometimes to a depth of 190 ft. The method commonly used is basin irrigation in which the water is admitted into a depression round each tree. To prevent the development of gummosis the water is kept from actual contact with the trunk by a mound of earth drawn up to the tree within the basin. The trees are adversely affected if the chlorine content of the irrigation water is greater than 350 parts per million. Farmyard manure is applied when the rains begin in September to October at the rate of 66 lb. per tree together with other fertilizers such as sulphate of ammonia 2-3 lb. per tree. Lysimeter trials at Mikveh Israel Agricultural School have shown potash and phosphoric acid to be necessary for the first ten years after planting. A suitable dose is 1 lb. of superphosphate and $\frac{1}{2}$ lb. sulphate of potash per tree. Lime deficient soils are dressed with ground limestone or slaked lime, according to whether the soil is light or heavy, at the rate of 4-6 cwt. every 2 or 3 years. Black scale is prevalent in the north and is controlled by compulsory fumigation twice yearly. Black rot (*Diplodia natalensis*) and gummosis are the most serious diseases. The grading, packing and export are regulated by law. The manufacture of by-products is undertaken, at present, on a small scale. Research work is conducted at the Mikveh Israel Agricultural School on vegetative propagation and manuring, at the Jewish Agency Research Experiment Station, Rehovoth (subsidized by Government) on all aspects of citrus cultivation and the utilization of by-products, and by the Department of Agriculture. Sieff Research Institute undertakes work of a more fundamental and long range nature.

540.. DALLAS, W. K.

634.334

Lemon culture.*Bull. N.Z. Dep. Agric.*, 96, 1936, pp. 24.

Lemon culture in New Zealand has developed into a useful industry in the last 20 years, the main commercial varieties grown being Lisbon and Eureka. Rootstocks are Citronelle, a horticultural variety of rough lemon (*Citrus limonia*), sweet, sour and trifoliate orange and grapefruit. Rough lemon is sensitive to cold and susceptible to collar-rot, bark-blotch, gummosis and citrus verrucosis in heavy or wet soils. It is deep rooting and produces vigorous trees on light soils. Sweet and sour stocks are more resistant to disease than rough lemon. The trees come into bearing later, but their productive life is longer. Sweet orange is suitable for light, well-drained soil. It has a shallow rooting system. The N.Z. stocks are raised from selected pips of the Cook Island sweet orange. Sour stock is deep rooting and does well in most situations, especially on heavy soils. Trifoliate requires a rich heavy loam. It has a dwarfing effect on the scion. It is not used commercially. Grapefruit is recorded to be susceptible to collar rot and gummosis in heavy soils. It develops a strong lateral root system at a lower depth than sweet orange. The most suitable soil for lemons in New Zealand is a deep sandy or clay loam over a porous subsoil, but most orchard areas will require additional drainage. Wind-breaks should be established 2 years before the orchard is planted, for young lemon trees checked in growth by exposure for several seasons seldom make good trees. A system of pruning is described at some length which, it is claimed, will produce the maximum of fruit bearing. Relatively deep cultivation round the young trees for the first few years is advocated and surface roots should be cut. If this is not done, the lemon will develop a surface rooting system which will be detrimental to yield in after years. The above are but a few points. The bulletin actually deals with the entire system of lemon culture in New Zealand from the first selection of the ground for the orchard to the final marketing of the fruit.

541. BACHELOR, L. D. 634.334
 Problems of lemon industry under investigation at experiment station.
Calif. Citrogr., 1936, 21 : 322, 354-5.

Certain investigations in progress at the citrus experiment station, Riverside, are mentioned in the course of an address to lemon growers in California. Rootstock trials from 1927 include sweet and sour orange, rough lemon, tangelo, citrange and others not commonly used as stocks for Eureka and Lisbon lemons. Stock influence is apparent not only between varieties of stock but within the species. There are for instance good and poor strains of sour orange. Different scion strains of both Eureka and Lisbon do not always act alike on similar rootstocks. Notable individual trees of Eureka and Lisbon are being propagated both from rootstock and top for field trial. The relative susceptibility to brown rot gummosis of different strains of citrus is being observed. Notable response to zinc spray application has been obtained from Eureka lemon on gravel soils and the duration of effect of sprays and possible modifications in the composition of the fruit of treated trees are being studied. There appears to be a needless waste of water in irrigation due to excessive run off or unnecessarily deep percolation during spring and autumn. The search for parasites for control of the various scales has given hopeful results. Every kind and method of fumigation, dust and spray is being tested in the attempt to control red scale, red spider, thrips, etc. New principles in dusting machines are being worked out. Fungus diseases are also being attacked both directly and by the selection of immune varieties. The internal decline of lemon—on which a special bulletin is soon to be issued—is attributed to water supply. Extensive studies covering all aspects of the nitrogen requirements of citrus plants are in progress. The validity of recent statements, which have caused some alarm, to the effect that the soils are becoming saline under the influence of irrigation is being examined for all types of citrus soils.

542. VAN DER PLANK, J. E. AND TURNER, F. A. S. 634.31 : 581.192 : 631.85
 Are our sour oranges due to lack of phosphorus ?
Fmg. S. Afr., 1936, 11 : 59-60, bibl. 6.

It is shown from work in other countries* that phosphorus decreases acidity in many fruits. Takahashi in Japan showed that this applies also to citrus. The soils of South Africa are deficient in phosphorus and the acidity of the orange is at least 2 per cent. greater than that of the competitive Brazilian fruit. The problem, however, is not to be solved by the application of phosphorus to the soil, since experiments at Buffelspoort have shown that even with the very high application of 40 lb. of superphosphate per citrus tree not more than 1 per cent. was absorbed in two years when the fertilizer was trenched into the root zone and still less when it was merely forked in. Thus at £4 per ton the superphosphate actually used by the tree apart from that which remains in the soil works out at about £400 per ton ! The whole problem of fertilizing with phosphates needs investigation and should not be insoluble.

543. SHAMEL, A. D. AND POMEROY, C. S. 634.31 : 575.252
 An inherent unstable strain of the Valencia orange.
Calif. Citrogr., 1936, 21 : 153, 186-7.

A study was made of the bud variations in a Valencia orange orchard (Hart's Tardiff strain) in Southern California in order to obtain some systematic information as to the frequency of the occurrence and the nature of the bud variations in the full bearing trees of a commercial orchard, and also to determine the number and commercial characteristics of oranges with navels in the crop under observation. Classes of fruit variations and percentage of trees affected were as follows:—(1) corrugated or ribbed, worthless commercially 4.38%, (2) unproductive variations 2.73%, (3) navel fruits—these oranges seemed superior in several ways to the ordinary Valencia, and are now being propagated for trial—1.77%, (4) long fruits 0.86%, (5) small, smooth fruits 0.73%, (6) coarse fruits 0.57%, (7) various rinds, raised, sunken, and sectorial chimeras 0.49%, (8) pear-shaped fruits 0.28%, (9) flat fruits, strikingly oblate shaped fruits peculiar to this strain 0.16%, (10) small coarse fruits 0.14%, (11) miscellaneous fruit variations transmissible through budding 0.47%. Foliage variations:—(1) narrow leaves—

* Takahashi, *Studia Citrol.* 1931, 5 : 1 : 37-54.

this variation produces few and small fruits—0.53%, (2) variegated foliage or periclinal chimeras 0.44%, (3) dense foliage, leaves set abnormally close together and over-vigorous in growth 0.33%, (4) witches broom—worthless bushy growths not properly understood and transmissible through bud propagation—0.04%, (5) miscellaneous variations capable of transmission through budding 0.16%. In conclusion it is pointed out that the Hart's Tardiff strain is inherently unstable, and that such instability is uneconomic. Since the best fruit of this variety has many valuable characters, it is desirable and not impossible that a stable substrain bearing high quality fruit should be isolated. It is suggested that this could be done or that at least the existing strain could be rendered much purer by systematic bud selection practices.

544. HAAS, A. R. C. 634.3 : 581.192

Phosphorus content of citrus and factors affecting it.

Soil Sci., 1936, 41 : 239-57, bibl. 15.

The percentage of phosphorus is highest in lemon flowers, decreasing in the fruit with advancing maturity. There are marked varietal differences. The percentage of phosphorus in peel and pulp is greater in lemons than in oranges and is increased by manuring with nitrate of soda. The percentage of phosphorus is greater in mottled than in healthy leaves. High percentages of phosphorus in healthy leaves indicate low nitrogen supply. Determinations of phosphorus in leaves are not in themselves an adequate basis for conclusions regarding the needs of the leaves for phosphates. The percentage of inorganic phosphorus in citrus leaves exceeds the sum of the organic and phospholipid fractions.

545. HAAS, A. R. C. 634.334-1.535-1.85

Phosphorus relations of lemon cuttings grown in culture solutions.

Bot. Gaz., 1936, 97 : 794-807, bibl. II.

The concentration of phosphate in the culture solution in relation to the growth and composition of Lisbon lemon cuttings was studied. Symptoms of phosphorus deficiency appeared in cuttings grown in solutions containing 0 to 0.2 p.p.m., but disappeared at 2 p.p.m. Cuttings grew well in solutions containing 105 p.p.m., provided that the solutions were well aerated. Percentages of phosphorus in mature, original leaves of the cuttings increased with increasing phosphate concentration in the culture solutions contrary to the habit in the field where the percentage of phosphorus in the leaves decreases with maturity. The percentage of reducing sugars in the mature leaves (not the original leaves of the cuttings) is at a maximum at the phosphate concentration range of 1-10.5 p.p.m. Percentages of non-reducing sugars increase with increasing phosphate concentration. There appears to be a relation between the percentages of phosphorus in the culture solution and in the dry matter of the leaves and also between these percentages and those of sucrose. Phosphate deficient lemon leaves, just as leaves containing excessive phosphorus, have a greater acidity than healthy leaves. The percentages of total ash, calcium, potassium, total and nitrate nitrogen in the new mature leaves were greatest at the lowest concentrations of phosphate, viz. 0.0125-0.075 p.p.m. The longest roots are produced in the lowest ranges of phosphate concentration and the shortest in the highest range. Plants grown in abundant nitrate but deficient phosphorus are nitrogen starved, since the absorbed nitrogen remains unchanged in the tissues. Iron must be kept out of the solution when phosphate concentration is being maintained.

546. PROVAN, J. L. 634.3-1.547.6

Maturity standards for citrus fruits.

J. Dep. Agric. Vict., 1936, 34 : 236-8, 272.

Early ripening and immature citrus fruit cannot be distinguished by their appearance. Standards of maturity have been devised for Victoria, Australia. Oranges containing more than 1.6 of acid are considered immature. In determining immature navel oranges the amount of acid in 10 cubic centimetres of orange juice shall require not more than 26 cubic centimetres of standard alkali, in this case deci-normal sodium hydroxide, to neutralize it. The seed or common orange is allowed 30 cubic centimetres of alkali. The test is simple and can be performed by the grower, the necessary apparatus being stocked by chemical supply firms

in Melbourne. Attention is called to the fact that oranges even on the same tree may vary in time of maturity, those on the lower parts of the tree ripening sooner than those above. At present there is no maturity test for grapefruit, though one is desirable. Certain observations were made to discover whether this was practicable. The acid test was found to be unworkable, because the acidity of the grapefruit scarcely varied from May to November in fruit from Merbein and from May to July in fruit from Swan Hill. Much grapefruit is marketed in June when there is a natural drop, and no point could be decided on as an adequate standard, the more so as locality appears to influence acidity. A marked development of flavour, however, occurred early in July, and it is suggested that, except in favoured districts where flavour develops early, no fruit should be marketed early in the season other than those which drop naturally.

547. COPEMAN, P. R. v. D. R.

634.31 : 581.192

The composition of orange skins.

J. Pomol., 1936, 14 : 205-15, bibl. 9.

The skins of Washington Navel oranges from lead arsenate sprayed and from unsprayed trees growing in the Eastern Districts of the Cape Province were submitted to analysis at weekly intervals over a growing period of 3 months. The methods of analysis are detailed. The amount of pectin in the dry skin was slightly greater in the sprayed than in the unsprayed fruit, the difference, namely 1.02, being significant. This difference remained constant over a 3 month period and neither increased nor decreased significantly with time, as might have been expected, had lead arsenate had any effect on a given constituent. The same was found with regard to other factors in the sprayed and unsprayed fruit, so that present results do not indicate that spraying has any direct effect on the skin constituents investigated. The following constituents in the pulp and the skin were determined:—Invert sugar, nitrogen, ash, potash, lime, phosphoric oxide. Results of analysis point to greater metabolic activity in the pulp during the growing period. The fact that there are decreases in the concentrations of certain factors seems to indicate that in these cases the supplies must be laid down in the early stages of growth and that these factors are more or less structural in function. The factors with the exception of phosphoric oxide show a greater rate of relative change in the skin than in the pulp. The pectin was determined (as calcium pectate) in the skin and mean values for this agree well with those of Nanji. In the skin all the mineral constituents decrease significantly with time and, phosphoric oxide excepted, the relative rates are greater in the dry skin than in the dry pulp. This suggests that the mineral constituents of the skin are laid down in the early stages of growth. The fact that the proportion of lime in the ash of the skin is much greater than that in the pulp accords well with the assumption that the lime is closely related to the cell-wall structure of the fruit. A high degree of correlation was found between the ash content and nitrogen content of both the pulp and the skin. It is suggested that the ash may play some part as a carrier of nitrogen.

548. ILYASHENKO, K.

634.3-1.542

Winter pruning of citrus trees. [Russian-English summary.]

Sovyaishskia subtropiki, 1936, 6 : 53-9.

Systematic or severe pruning is not necessary with citrus, except to rejuvenate a neglected tree. The practice of removing the lower branches or altering the shape of the crown when pruning in winter is condemned. Light pruning is occasionally beneficial and instructions on how this is to be done are given.

549. SHAMEL, A. D.

634.31-1.542.24

Report on a girdling test with Washington Navel orange trees.

Calif. Citrogr., 1936, 21 : 320, 343.

The object of the experiment, of which this is the 5th progress report,* was to compare the quantity and quality of fruit of full bearing, girdled Washington Navel with that of non-girdled

* Earlier accounts of this experiment appear in *Calif. Citrogr.*, 1931, 16 : 263; *Ibid.*, 1932, 18 : 38 (*H.A.*, 1933, 3 : 1 : 87); *Ibid.*, 1934, 18 : 328 (*H.A.*, 1934, 4 : 1 : 105); *Ibid.*, 1935, 20 : 94 (*H.A.*, 1935, 5 : 1 : 94).

trees and to observe the effect of girdling on the behaviour of the tree. The technique consisted of cutting a complete circle round the trunk through the cambium to the wood with a sharp knife. If more than one girdle is made, the rings are spaced an inch apart. Results show a consistent increase after initial girdling but a consistent reduction in yield after successive girdling which became significant with the seventh or eighth. When girdling was discontinued after the first or any successive girdling, a loss of yield occurred which equalled or exceeded the increase from the first girdling. The vigour and growth of the tree declined, somewhat after the seventh or eighth girdling. No effect was obtained either way on grade size of fruit or chemical composition of fruit. Anticipating the final report to be issued next year, it is concluded that the practice of girdling healthy, full bearing Washington Navel orange trees is undesirable.

550. OPPENHEIMER, C. 634.31 : 581.162
On citrus fertilization with special reference to seediness and seedlessness of the Jaffa orange.
Hadar, 1935, 8 : 261-7, 291-6, bibl. 19, reprinted as *Bull. Rehovoth agric. Exp. Sta.*, 18, 1935, pp. 28.

The author reviews the problems associated with fertilization in citrus trees in the light of work done in other countries and by J. D. Oppenheim and himself in Palestine. He discusses such factors as times of blossoming, numbers of ovules, pollen germination, parthenocarpy in relation to pollination and fertilization, ovule degeneration, and apogamy. The Shamouti or Jaffa orange is exported as a seedless type, and hence the development of seeds in certain fruits is an undesirable feature. It is thought that the causes of seediness may be sought in one, or a combination of, three groups of factors, namely :—(a) external factors such as soil, climate, fertilizers, rootstock, etc. ; (b) hereditary factors transmitted by budding, i.e. different strains of the variety ; and (c) the effects of cross-pollination. With regard to the last of these, tests made in 1933 indicated that, whereas Jaffa blossoms self-pollinated or cross-pollinated with sweet lime or Eureka lemon produced fruits containing on an average 0.5 seeds, blossoms cross-pollinated with Valencia, Satsuma, a tangerine and Temple orange produced fruits containing on the average 1, 2, 4 and 6 seeds respectively. The same question was also studied under natural conditions in the grove by comparing fruits from Jaffa trees growing in close proximity to trees of other species and varieties with fruits from trees isolated from other varieties. Although such a method must obviously be somewhat inexact, the results obtained in two years clearly confirmed those obtained in the cross-pollination tests. The proximity of the varieties Baladi, Valencia, Duncan grapefruit, and all sour oranges and tangerines with the exception of Satsuma produced marked increases in the number of seeds in Jaffa fruits, whereas sweet lime, Lisbon lemon and Marsh grapefruit appeared to have no influence. On the other hand cross-pollination cannot be the only factor contributing to seediness. The presence of isolated Jaffa trees which produce seedy fruit, and the discovery that pollen from different Jaffa trees may show striking differences in percentage germination, which in turn have been correlated with mean numbers of seeds produced, suggest that genetic differences exist between certain trees. The question of budwood selection is at present being examined in this connection.

551. FERNANDO, M. 634.3-2.19
Mottle leaf of citrus ; its incidence and control.
Trop. Agriculturist, 1936, 86 : 332-4, bibl. 4.

Mottle leaf is a serious disorder of citrus trees in Ceylon occurring on a variety of soil types and with a number of varieties, of which mandarins appear to be the most susceptible. The characteristic symptoms are the appearance of irregular yellow areas between the leaf veins, each arising as a slightly chlorotic spot which widens and deepens in colour. The tissues over the midrib and larger veins retain their chlorophyll. In serious cases the tree is dwarfed and the quality of the fruit deteriorates. The disease is a functional one that can be corrected by the application of zinc sulphate, though it is probably not a simple zinc deficiency disease. The

best control in Ceylon has been obtained by spraying the trees with the following mixture:—zinc sulphate 10 lb., hydrated lime 5 lb., Actin $\frac{1}{4}$ lb. or Solol $\frac{1}{2}$ lb., both proprietary spreaders, water 100 gall. The zinc sulphate to be used should be that containing 98 per cent. water-free zinc sulphate. The hydrated lime is first added to the water and afterwards the zinc sulphate, dissolved in a little water, is poured in. This is followed by the spreader and the whole is well stirred. The mixture requires continual agitation during use.

552. CHANDHURI, H.

634.3-2.4

Diseases of citrus in the Punjab.*Indian J. agric. Sci., 1936, 6 : 72-108, bibl. 56.*

The diseases of citrus in India are many and have hitherto been little studied from the point of view of control. Citrus varieties cultivated commercially are santara and Malta orange, lime, citron and pomelo. Sour orange and rough lemon are grown extensively as hedge plants. Other varieties are grown sparsely in gardens. The author claims to have had all the local citrus, of which the nomenclature and classification was extremely confused, botanically named and assigned their nearest English equivalents by Professor Tanaka of Japan who visited the district. Although Tanaka's system of classification is not that generally used, it has resulted here in a most welcome clarification and his identifications of these Punjab citrus are worth noting for future reference. The diseases here dealt with at length are: 1. Wither-tip caused by the fungus *Colletotrichum gloeosporioides* attacking the shoots and stem ends of the fruit. This is distinct from but very similar to the wither-tip of lime which has caused such havoc in Dominica W.I. and was at first confused with it. The causal agent of the Dominica wither tip is *Gloeosporium limetticolum*. It is considered that the prevalence of wither-tip in the Punjab is largely due to ignorance and careless cultivation. The farmer has not yet understood that an old diseased tree can infect and destroy a whole new plantation, even before the latter has time to come into bearing. The sour, sweet and mandarin oranges are the most frequently attacked. The following rootstocks seemed to impart a certain resistance to the varieties grafted on them:—khatti (rough lemon) Eureka lemon, turang (citron) and kimb. Sour orange stock provided no immunity. 2. Chlorosis of a malta orange, *Citrus sinensis*, grove was investigated. The chlorotic areas of the leaves become slightly more acid than the adjoining green portions. No correlation with soil condition was found. Injection or spraying with ferrous sulphate in 0.0001 per cent. solution has been fairly efficacious. 3. Saprophytic sooty moulds cause imperfect ripening of the fruit and often impart to it a bitter and fermented taste, and some of the fungi taking part in the sooty incrustations such as *Alternaria citri* or *Cladosporium herbarum* var. *Citri*, nail head rust, may cause considerable damage to the crop. Experiments in the control of the fungus diseases mentioned were carried out and certain recommendations are made. Bordeaux combined with ferrous sulphate as a sticker proved most generally effective and the ferrous sulphate reduced chlorosis of the leaves in many orchards.

553. PERLBERGER, J.

632.411.2 : 634.3

Phytophthora* stem and tip blight of citrus seedlings.Hadar, 1936, 9 : 145-50.*

A detailed description is given of a disease of citrus seedlings caused by *Phytophthora parasitica* and *P. citrophthora*. The disease, hitherto unrecorded for Palestine, causes great damage in the sweet lime seed beds. The main symptom of the disease is the complete browning or blackening of the affected parts, usually, though not always, beginning at the growing point and spreading rapidly to the other leaves. The root and root collar especially in neglected seed beds are also affected. Culture experiments seemed to indicate that the blackening of the tips is caused by *P. parasitica* and that the browning of the lower parts of the stem is caused by *P. citrophthora*. Infection experiments by inoculation of healthy seedlings failed, but infection of fruit resulted in rotting of the seeds within the fruit or in the ground, or of the seedlings directly

after germination. Infection of the soil also produced the disease on germinating plants. The question of the healthy seedlings which have made some growth and subsequently become infected is still unanswered. Control measures consist in the use of seed from whole, healthy fruit only, preferably from the upper parts of the tree, the disinfection of all seeds by soaking in Uspulon or Ceresan at a concentration of 1 : 1000, and the disinfection of the soil with a formaldehyde concentration of 1 : 100. After germination seedlings should be sprayed with bordeaux mixture 0·5% and a week later with a 1% solution. The use of hotbeds or excessive humidity are favourable to the disease. Infected seedlings should be at once removed.

554. KLEIN, H. Z. 632.654.2 : 634.3
Contributions to the knowledge of the red spiders in Palestine. I. The oriental red spider, *Anychus orientalis*, Zacher.
Hadar, 1936, 9 : 107-11, 126-32, bibl. 10.

This red spider is the variety most dangerous to citrus trees in Palestine. It produces up to 18 generations during the year, the duration of development from 8 days to 2 months depending on climatic conditions, especially temperature. Its normal activity is limited between 18° C. and 34° C. A full life history of the pest is given. Control is effected by spraying with white-oil emulsions in a 1·5% concentration and by dusting with sulphur, the number of sprayings or dustings during a season varying with the district. Its main natural enemy is the coccinellid *Synmus sp.*, but this is unsuitable as an agent for biological control owing to its disappearance during the summer months when the red spider is most in evidence.

555. RIVNAY, E. 634.31-2.772
Infestation of oranges by the Mediterranean fruit fly during the autumn in Palestine.
Hadar, 1936, 9 : 134-7.

The various seasonal infestations of oranges by fruit fly are characterized and described, the autumn attack occurring from September to October. This is due primarily to a premature ripening of the fruit, a condition which is brought about by late spraying with oil emulsion against red scale, by insufficient soil moisture, or by some form of weakness in the tree. The proximity of infested summer fruit of various kinds does not appear to be of great importance. The state of ripeness of the orange is the decisive factor.

556. HUNT, R. W. 634.3-2.95
The art of spraying citrus trees.
Calif. Citrogr., 1936, 21 : 375, 392-4.

Material. From the mechanical standpoint, semi-stable and stable oil emulsions gave the best uniform coverage and are preferably administered in several light applications a year rather than in one heavy treatment. **Spray equipment.** Moderate agitator speed in the power sprayer (150 r.p.m.) is desirable. Over-agitation causes foaming, loss of pressure and the formation of air pockets in the pump. A material requiring high-speed agitation is better avoided, unless the machine used is specially adapted for the purpose. The importance of volume in the pump is stressed, since without it all other factors such as gun type, size of aperture and hose are of little consequence and in addition low volume pumps easily clog. Pressure, though important, is less so than is sometimes thought. A 2-gun outfit should carry a gauge pressure of 375-400 lb. while a 3-gun should have 400-425 lb. High pressure may result in too fine a mist or in injury to the leaves and fruit at close range. The most desirable hose is 60-75 ft. in length with an internal diameter of less than 15/32 of an inch. An oil resistant synthetic inner tube known as Duprene is shortly to become available, and will obviate the softening of the inner tube which is at present frequent with oil sprays. Few spray guns have sufficient capacity due to the reduced size of the waterways between hose connexion and nozzle. The nozzle disc giving the most efficient coverage is 8/64 inch. A nozzle this size requires

that the gun shall be pointed only once at a branch to ensure thorough wetting. A tower and a 6 ft. gun rod should be used with trees of average size, and there should be sufficient volume to force the spray into the interior of the foliage clusters. A steel hydraulic, telescoping tower extending 20-25 ft. is recommended, being both handy and safe. *System.* A satisfactory method is to spray the inside of the tree on the first circuit of the tree and the outer surface on the return. The gun should be held at an angle to the tree and not pointed straight into it. If a tower is in use, the man in it should save material by confining his activities entirely to those parts not easily reached from the ground and should shut off the gun when this is accomplished.

557. OPPENHEIM, J. D. AND ELSE, D. L. 634.31-1.564
The determination of the shape of some varieties of oranges in relation to the methods of packing.

Hadar, 1935, 8: 255-8, 285-90, bibl. 5.

Shape indices were determined for a large number of Shamouti (Jaffa) and Valencia Late oranges. The index is defined as the greatest breadth of the fruit expressed as a percentage of its length, and the measurements were made by means of a specially devised apparatus, termed a fructometer, of which a description is given. The index for the Shamouti variety was found to be approximately 91, i.e. an oval form, and for Valencia Late 99, i.e. an almost round form. Measurements made of Shamouti oranges from a young and an old grove confirmed the general impression that fruit from young trees is larger than that from old. Although size of fruit varied to a considerable extent, the index was found to remain the same, as was shown by the high correlation coefficients obtained between length and breadth. The sizing of the oval Shamouti orange by a machine grader is based solely upon the breadth of the fruit, and, since in hand graded boxes differences in lengths of individual fruits were found to be greater than differences in breadths, it is concluded that hand-grading is also based on breadth alone. Estimation of the breadths of fruits from boxes of different counts indicated that there is considerable overlapping of fruit sizes. It is suggested that box-sizes might be decreased in number to two, or possibly even one, and at the same time grading counts of 96, 112, 128, 136, 140, 142, 144, 160 and over 294 be eliminated, leaving only counts of 100, 120, 150, 180, 210, 240 and 294.

558. WELLMAN, H. R. 634.31 : 338
Some economic aspects of regulating shipments of California oranges.
Circ. Calif. agric. Exp. Sta., 338, 1936, pp. 29.

The results of an analysis of the major factors which influence the seasonal average f.o.b. prices of California oranges is presented in non-technical form and the problem of estimating the effects upon returns to growers of regulating the volume of orange shipments is discussed. Summer and winter oranges are considered separately. The former consist mainly of Valencias shipped during May to the end of October, the latter mainly of Washington Navelles shipped during November to the end of April. Main factors affecting the f.o.b. prices of summer oranges measured (other factors exist but were unmeasurable with the data available) were (1) California shipments, i.e. the larger the shipment, the lower was the price obtained; (2) trend of demand; (3) buying power of consumers; (4) competing-fruit production; (5) average sizes of Valencia oranges, small oranges fetching less per box than large ones. With winter oranges factors (1), (2) and (3) account for most of the variations in the seasonal average of f.o.b. prices, but the competition of grapefruit is certainly an increasing influence. In both summer and winter fruit the confidence of the trade in the stability of prices is important in maintaining them. The conclusions reached are that in the case of summer and to a less extent winter oranges returns to the grower can be materially increased in large crop seasons by the regulation of the volume of shipments (without limitation of the total supply) as a continuous device, and the limitation of the total supply as an emergency device in times of glut, when prices would otherwise be at distressingly low levels.

559. EDITORS OF HADAR. 634.3 : 658.8
What the products companies mean to the citrus growers.
Hadar, 1936, 9 : 157-8.
 From the experiences of California Citrus Exchange Products Companies, as related by the General Manager of the companies, it is shown that, while the manufacture of citrus by-products such as citric acid is not actually profitable, it does raise the standard and therefore the price of shippable fruit by relieving the market of culls and inferior fruit and produces some return to the grower for fruit that would otherwise be dumped. The California Citrus Exchange Products Companies relieve their members of all surplus fruit. The cash obtained by the companies for the fruit processed or otherwise disposed of is spread over the total of fruit received from members when payment is made, though part of the fruit may have had to be given away. The difference between the Exchange and private processing companies is that, while a private company may pay 25 instead of 5 dollars a ton for fruit, they will only take and pay for what they can use, whereas the Exchange will take the entire surplus.

560. HAAS, A. R. C. 634.653 : 581.145.2
Growth and water relations of the avocado fruit.
Plant Physiol., 1936, 11 : 383-400.
 End-spotting is a cause of heavy loss of thin-skinned avocado fruit. In some cases the larger end of the fruit withers and dries and in others it may crack till the seed is exposed. Another type consists of the formation of small dark spots known as speckles which are dry, depressed areas in the skin. Among the factors involved are an over-maturity of the skin in the affected portion of the fruit and a desiccation of the fruit surfaces as a result of an extreme water deficit in the tree. The problem is to be examined from every aspect. This paper discusses certain phases of the growth and water relations of the avocado fruit. No conclusions are drawn regarding the horticultural application of the results obtained.

561. HAAS, A. R. C. 634.653-2.19
Chlorine in relation to ring-neck in avocado fruits.
Calavo News, 1936, June-July, pp. 12-3.
 Ring-neck disease is the name given to the dying off of a complete ring of surface tissue on the pedicel of avocado fruits in California. It is thought that a high concentration of chlorine in this portion of the fruit may be associated with the trouble. Chlorine concentration is always slightly higher in the stem portion than the tip portion of avocados. Pedicels of healthy fruit were found to contain 0.41 per cent. of chlorine, severely ring-necked fruit 1.42 per cent. The clean and diseased fruits were not from the same locality. The over absorption of chlorine may possibly be due at least in part to its presence in excess in certain irrigation water (such water is known to cause leaf tip burn and defoliation), to a lack of irrigation water, or to deficient nitrogen fertilization.

562. BAKHTADZE, K. 633.85
Tung tree selection. [Russian-English summary.]
Sovyaishskia subtropiki, 1936, 6 : 22 : 19-34.
 The results of work done by the author in hybridizing and selfing *Aleurites Fordii* and *A. cordata* are given. Inter-pollination between varieties of *A. Fordii* gave the largest percentage of useful new strains. Crosses between *A. cordata* and *A. Fordii* gave entirely normal seeds but small fruit, while the reverse cross gave a better fruit than any resulting from pollinations within the species. The strains are classified as follows. Frost resistance, character of bloom, duration of reproduction period, fruit bearing, type of clusters, number of niduses in the fruit, size of fruit, size of seed, shape of fruit, amount of seeds produced, thickness of husk, colour of fruit.

TROPICAL CROPS.*

563. SUBRAHMANYAN, V. 631.416.1

Determination of nitrogen in soils.*Agric. Live-Stk. India, 1936, 6 : 284-8, bibl. 13.*

A review of recent improvements and modifications in the methods of determination of nitrogen in soils with a note on the possibility of the simultaneous estimation of carbon.

564. READ, W. S. 631.312

Adapting the indigenous country cart of India to pneumatic tyre equipment.*Agric. Live-Stk. India, 1935, 5 : 473-9.*

A simple inexpensive method of conversion is described in which the costs, beyond that of the tyres and axle, are well within the reach of the poorest native cart owner. The adjustments can be made by the village carpenter. The advantage of pneumatic tyre equipment lies in reduced draught and, therefore, a faster pace and greater load capacity, thus increasing the "pay load" per mile, longer life of vehicle owing to reduction of shocks, longer working life of draught bullocks. An enormous reduction in wear and tear of roads would also result, if the use of pneumatic tyres became general. The impossibility of the peasant under existing conditions being able to purchase even the tyre equipment is recognized. For him to obtain it, either the price would have to be drastically cut, or its use would have to be subsidized, and the co-operation of the tyre companies should be invoked.

565. GEORGI, C. D. V. AND OTHERS. 632.951.1

Varietal and manurial trials with derris.*Malay. agric. J., 1936, 24 : 268-81, bibl. 2.*

The following species were included in the investigation *D. elliptica*, *D.e.* Sarawak creeping, *D. malaccensis* var. *sarawakensis*, *D. malaccensis* tuba merah. The plants were 24-26 months old and samples of each variety were taken from both Kuala Lumpur and Serdang. No specific differences were found in the amounts of plant nutrients in these varieties nor any significant interaction between species of *Derris* and artificial manures. The amount of nutrients removed by the plants from the soil, however, is considerable. Manured and limed plots gave significantly better yields than the controls. No definite relationship could be traced between toxin content and manurial treatment. Planting material should be selected with care owing to the great variations in toxicity between individual plants. The degree of toxicity does not seem to vary with change of environment. *Derris elliptica* Sarawak creeping is recommended as likely to prove the best under estate conditions and to meet the present market standards of 18 per cent. ether extract or 4 to 5 per cent. rotenone.

566. BOSE, R. D. 633.524.1

Studies in Indian fibre plants No. 4. The root system of the sunn hemp*(Crotalaria juncea L.).**India J. agric. Sci., 1936, 6 : 351-60, bibl. 7.*

Sunn hemp is now being taken up as a suitable substitute for Russian hemp (*Cannabis sativa L.*) and it is also valuable as a green manure in the tropics. It is being studied at Pusa with the object of producing strains suitable for the different parts of India. It must be cross fertilized to set seed and this has proved a limiting factor in the isolation of pure lines, though promising strains have been secured by mass selection. A mesophytic and a xerophytic type of root system have been recognized and differentiation between the two has been made according to the depth of the tap roots, lateral spread of secondary roots and nature and development of fibrous roots. Sub-divisions in each type are based on the average depth of the tap roots. The tap roots of the mesophytic type had less depth and the secondary roots were more spreading than in the xerophytic type. The localities in which each of the two types prevailed are given. There is a fairly high positive correlation between the type of root system and the height of plants.

* See also 431.

567. BOBOKHIDZE, A. 633.72-1.55

Tea plucking. [Russian-English summary.]
Sovyashskia subtropiki, 1936, 6 : 22 : 47-52.

Among a number of practical suggestions on tea plucking in S. Russia it is suggested that 3 leaves and a bud should be plucked from 5-leaved shoots and 2 leaves and a bud from 4-leaved ones. There will then remain on the tree 2 normal and 1 fish leaf. In June and July, when plucking is done from shoots of 3 and 4 leaves, only one leaf is left on the stem and from August to October only the fish leaf is left. Regular pluckings increase yield and improve the quality of the plucked leaf.

568. HOUK, W. G. 633.73 : 581.48

The ovule and seed of *Coffea arabica* L.
Science, 1936, 83 : 464-5, bibl. 2.

Certain morphological features of the ovule of *Coffea arabica* have been misinterpreted or overlooked in the past. First, there is no integument, and secondly, the endosperm is evanescent, disintegrating as the embryo enlarges, so that it is non-existent in the mature seed. The nutritive tissue around the embryo is actually perisperm, resulting from enlargement of the nucellus.

569. GETHIN-JONES, G. H. 633.73-1.45

Conservation of soil fertility on coffee estates.
E. Afr. agric. J., 1936, 1 : 456-62.

The problem is bound up with the maintenance of the humus content of the surface soil and with the prevention of erosion. Humus and the nitrate supply of the soil can be kept up fairly inexpensively in the moister districts by green manuring, but in the drier areas organic manures or composts must be added. In the coffee districts of Kenya a combination of the two is usual. Soil moisture in dry districts can be maintained by clean cultivation, leaving a dry dust layer which prevents the moisture in the lower layers from evaporating. A grass mulch is most efficient in conserving moisture throughout the soil profile and is also a protection against erosion. Direct anti-erosion methods are often necessary. These are contour terracing of various kinds, contour cover cropping or contour hedging. The different methods are outlined and references are given to recent publications containing fuller details.

570. IGLESIAS, B. R. 633.73-1.542

Pruning coffee trees.

E. Afr. agric. J., 1936, 1 : 487-97, translated from *Revista del Instituto de Defensa del Café de Costa Rica*, 1935, vol. 1, No. 4.

A new system of pruning which has been practised for 3 successive years with very satisfactory results at the Coffee Experiment Station in Costa Rica is described in detail and illustrated. The idea is to renovate yearly by pruning a small proportion of the tree, the exact branches to be removed being predetermined by rule and not by condition. Theoretically (though not in practice owing to accidental destruction of buds) a tree so pruned should retain its youth for 104 years. Further description is not possible in the course of an abstract and in the absence of the diagrams showing the yearly procedure for the first 12 years which clarify the explanations in the article.

571. CHEESMAN, E. E. 633.74 : 58

Position of the botanical researches at the end of 1935.

Fifth annu. Rep. on Cacao Research for 1935, I.C.T.A., Trinidad, 1936, pp. 3-4.

With the completion of the 5th year of cacao research the period of preliminary investigations closes and the second phase, that of consolidation, begins. In vegetative propagation, methods of obtaining standardized material from cuttings have been perfected and have thus laid open the way to investigations of stock influence, to the reduction of variance in field experiment and to all those investigations which have had to be put aside until the production of genetically

uniform material could be assured. The 100 types of cacao have been finally selected, resulting in an establishment of standards against which any new acquisitions can be compared, no matter what their origin. [36 of these types are described in the 2nd and 3rd Annual Reports and the remaining 64 in the present report, pp. 7-16.—ED.] Studies in botanical factors in relation to yield have also in a sense reached a point that marks a stage, in that observations of the natural behaviour of mixed trees in the field have been recorded over these years as a basis for analysis of the interactions between constitution and environment. Different pollen compatibilities and degrees of partial sterility have been revealed, and drastic manurial treatments have failed to affect natural periodicity of the reproductive cycle over the population as a whole. To advance further in these studies it is clearly necessary that clonal material should be used. The second phase, that of consolidation, will consist in testing the vegetative and seedling progenies of the selected trees. An experimental field consisting of 10,000 vegetatively propagated trees, 100 trees of each selection, will be laid out and form the material for the forthcoming experimental work which will deal with agricultural behaviour, time of bearing, disease resistance, yield and quality. Comparisons of the various types of vegetative propagation material and of the trees selected as clonal stocks will be made. Seedling progeny from selected trees will be grown on various types of soil for information on the inheritance of yield. A botanical collection of cacao types and nearly related forms from outside Trinidad will be added to the collection of Trinidad variations, which themselves show a wider range than for any equivalent area elsewhere.

572. CHEESMAN, E. E. AND SPENCER, G. E. L.

633.74-1.535

The vegetative propagation of cacao. VI. General notes on technique with cuttings. VII. Root systems of cuttings.

Fifth annu. Rep. on Cacao Research for 1935, I.C.T.A., Trinidad, 1936, pp. 4-7.

VI. The now perfected method of propagating cuttings for the production of clonal cacao plants is described. The cuttings are taken almost exclusively from young budlings grown for the purpose from the selected parent tree. This is more convenient than obtaining material from the field, since the exact condition of foliage, i.e. the first hardening of young leaves from a new flush, is rarely available when required, if collecting has to be done at a distance. Six-month-old seedling stocks are planted 3 ft. by 3 ft. in a nursery under controlled shade and budded with fan buds from the selected tree. In 4-6 months the first cuttings can be taken from the resultant shoots or the shoots may be allowed to grow and branch, thus yielding a greater number of cuttings. When sufficient fan material has been taken, chupon material may be obtained by cutting back the budlings leaving a few leaves or a lateral branch. Some of these cut back plants will produce chupon growth. This decapitated will produce further chupons from the axillary buds. The chupons are used as cuttings, or as budwood, if an increased rate of supply is needed. Once the cuttings are rooted it is preferable to obtain further supplies from these plants, the original budlings being destroyed to prevent possible errors due to shoots springing from the seedling stocks being mistaken for clonal shoots. The cuttings are set in concrete propagators 3 ft. by $2\frac{1}{2}$ ft. by 3 ft. high at the back and 2 ft. 10 in. in front. Glass covered with dampened cheesecloth or a calico-covered framework is used as a covering to the propagators and the whole is shaded by a calico roofing stretched on angle iron and stout wire. The rooting medium in which cuttings are set $4\frac{1}{2}$ inches deep is 6 inches of calcareous sand overlying 1 foot of coarse gravel and large stones. Drainage holes are provided in the propagators. Watering is done three times a day. Fan shoots have given 100 per cent. rooting in 3 weeks, chupons take up to 12 weeks. Thrips cause some trouble, since cuttings attacked lose their leaves and fail to root. Preventive control consists of dipping the cuttings before setting and again before potting in a 1 : 500 nicotine solution with a trace of soap. Cuttings are placed in water immediately on severance to prevent the intake of air at the cut end. Rooted cuttings are planted in locally made baskets having the capacity of a six-inch pot. When the roots show through the basket it can be planted entire in the field nursery. This is effected by setting it in the ground to half its depth, as sinking occurs when the basket rots and the light potting compost falls into the air spaces which it is impossible to avoid leaving

in the surrounding heavy field soil. VII. Root systems of plants grown from fan and chupon cuttings were examined when 2-2½ years old and compared with those of a 5-year-old seedling, the only seedling plant available in exactly similar soil. In both types of cutting the tap root of the seedling is represented by two or three vertical roots and its mass of surface fibrous roots is imitated on a smaller scale appropriate to the age of the cuttings. The initial differences noted by Pyke (*3rd annu. Rep.*, pp. 4-6; *H.A.*, 1934, 4:3:453) between fan and chupon rooting have not persisted.

573. POUND, F. J. 633.74.1.521

The completion of selection.

Fifth annu. Rep. on Cacao Research for 1935, I.C.T.A., Trinidad, 1936, pp. 7-16.

Sixty-four descriptions are given (completing the programme of one hundred, see Annual Reports 2 and 3) of cacao trees selected for further trial of their progeny for high yield and quality as indicated by size of bean.

574. POUND, F. J. 633.74-1.8

Studies of fruitfulness in cacao. VIII, IX and X.

Fifth annu. Rep. on Cacao Research for 1935, I.C.T.A., Trinidad, 1936, pp. 16-24.

VIII. Second year observations in an experiment designed to test the gross effects of applications of nitrogen, potassium and phosphorus on the cacao tree. In the second year of this experiment potash has again been largely responsible for the increased yields obtained. Phosphate has only been beneficial in the presence of potash. The value of nitrogen has not been apparent. Potash has been associated with a reduction of disease incidence (black pod, *Phytophthora palmivora* Butler) and phosphate with an increase. Balanced application of phosphate and potash might still further increase yield. IX. Differences between high-bearing and low-bearing cacao trees in response to inorganic manures. On a soil, where potash is relatively more deficient than phosphate, high and low yielding trees respond to applications of potash; neither type responds to phosphate in the absence of potash. Phosphate in the presence of potash gives further increases of yield from poor bearers. Although not apparent in the figures for high bearers analysis suggests that it has some importance here also. Nitrogen during the first two years decreases the yield of good bearers, but benefits poor bearers. X. Physiological effects of applications of nitrogen, potassium and phosphorus on the cacao tree. The intensity of fruit setting was increased and the periodicity of flushing, flowering and fruit setting was unaffected over two years by applications of sulphate of ammonia at a rate of 1,200 lb., sulphate of potash 600 lb. and superphosphate 600 lb. per acre, alone or in combination. Sulphate of ammonia and superphosphate applied alone resulted in increased setting being counterbalanced by increased wilting of cherelles. Sulphate of potash, in which the soil was deficient, gave the greatest increase in setting, while wilting was increased to a relatively smaller extent, leaving on the whole an increased yield. (Previous studies on these subjects will be found in the 3rd and 4th Annual Reports (*H.A.*, 1934, 4:3:460, 1935, 5:3:473).)

575. HARDY, F. 633.74 : 54

Summary of previous results, and the chemical programme of 1935.

Fifth annu. Rep. on Cacao Research for 1935, I.C.T.A., Trinidad, 1936, pp. 25-30.

The results obtained in the study of various problems by the chemistry section of Cacao Research over the past 5 years are concisely stated and the plans for future investigations are outlined. These include:—the investigation of the biochemical composition of both raw and fermented cacao of various categories in order to define the chemical attributes of quality; a continuation of the examination of the West Indian cacao soils and their nutrient relationships; a further study of the manurial and cultural treatment of gypseous soils and the effect of liming acidic cacao soils, and of the possible rôle of the rarer accessory nutrient elements in productivity

of cacao soil; an examination of the cacao soils of West Africa* from representative soil profiles, which may help to elucidate the nutrient relationships of the cacao tree under a different set of conditions to those hitherto examined.

576. HARDY, F. AND RODRIGUEZ, G. 633.74-1.4

Cacao soil surveys.

Fifth annu. Rep. on Cacao Research for 1935, I.C.T.A., Trinidad, 1936, pp. 30-4, bibl. 5.

A study by the profile method of two cacao soil types occurring in south central Trinidad.

577. McDONALD, J. A. 633.74-1.8

Manurial experiments on cacao.

Fifth annu. Rep. on Cacao Research for 1935, I.C.T.A., Trinidad, 1936, pp. 34-43.

Further results of manurial experiments on cacao in Trinidad are discussed. Preliminary results were presented fully in the 4th Annual Report (*H.A.*, 1935, 5 : 3 : 477), but owing to the heterogeneity of the material full statistical treatment of results will not be undertaken until the 1935 and 1936 crops can be compared with the combined 1933 and 1934 crops. The annual application of 2 lb. and 3 lb. of superphosphate for 3 years appears to be in excess of the requirements of cacao trees growing on a phosphate deficient, acidic clay soil. Light dressings of superphosphate still gave additional increases of yield after the 3rd consecutive annual application. A slightly larger immediate increase of yield is obtained with superphosphate manure compared with finely ground rock phosphate manure applied to acidic clay soil. Comparing the response to artificial manures of cacao trees on naturally shaded and on unshaded potash-deficient sandy soil, large increases of yield were obtained by the application of potash alone and in combination with nitrogen and phosphate, under both shaded and unshaded conditions, with a slightly better response on the shaded crop. Only one year's results are available, but they indicate that the presence of large shade trees need not adversely affect the response of cacao trees to artificial manures.

578. McDONALD, J. A. AND RODRIGUEZ, G. 633.74-1.416.8

The manganese content of West Indian cacao soils.

Fifth annu. Rep. on Cacao Research for 1935, I.C.T.A., Trinidad, 1936, pp. 43-7, bibl. 7.

The important effects of the minor elements on soil fertility has been demonstrated by recent investigations. Of these elements manganese is one. The manganese status of typical West Indian cacao soils in Trinidad, Tobago and Grenada, has been examined and the existence of definite and regular differences between the types has been established. Soils derived from calcareous sedimentary rocks and from igneous rocks contain a larger amount of manganese in their surface layers than soils derived from non-calcareous sediments and from recent alluvium. The low yield of cacao on certain gypseous clay soils in Trinidad and failure to respond to phosphatic manure may be attributable to the low manganese content of these soils. The evidence based on soil analysis is supported by spectroscopic leaf analyses, in which cacao leaves from non-gypseous alluvial clay soil were shown to contain 24 times as much manganese as leaves from a highly gypseous clay soil.

579. S.S. AND F.M.S. DEPARTMENT OF AGRICULTURE. 633.879

Gambier (*Uncaria Gambir*).

Agric. Leaf. Dep. Agr. S.S. and F.M.S., 11, 1936, pp. 6, bibl. 4.

Gambier is a semi-climbing woody shrub, from the leaves and shoots of which is obtained an astringent extract used in tanning and dyeing. It is also used for chewing in combination

* In co-operation with the Agricultural Chemists of the Departments of Agriculture of the Gold Coast and Nigeria.

with betel nut and lime. Hitherto it has been used as an intercrop with young rubber and its financial possibilities as a sole crop are unknown. A superior machine prepared product from Sumatra fetches a very high price compared with that of the ordinary "cube" or "bale". Gambier is raised from seed and the crop is productive for 12-18 years on newly cleared jungle land. Fertilizers would probably improve and prolong the yield, the crop being an exhausting one. A sunny, well-drained situation is required and a heavy and evenly distributed rainfall. The seedlings are transplanted during the rainy season when 4-6 months old. Planting distance is 6 ft. by 6 ft. or 1,200 plants to the acre. The first crop is harvested 12-15 months after planting. The young leaves and shoots give the best gambier and are obtained from the laterals of the main stems. They must be placed in the boiling pans immediately. Experiments indicate harvesting every 4 months to produce the highest percentage of gambier. Preparation consists of a series of boilings until the concentrated extract becomes syrupy and dark brown in colour. It is allowed to set and solidify, and, if "bale" gambier (60% of moisture) is required, is then cut into blocks and dried on racks. Cube gambier (10.5% of moisture) undergoes a further drying first in the sun and subsequently on racks above the boiling furnaces. The annual yield in Malaya is about 1,330 lb. of dry gambier per acre. Double this amount is said to be obtained under plantation conditions in Sumatra. [A complete account of gambier cultivation and preparation by native methods in West Borneo appears in *Landbouw.*, 1933-4, 9: 336-70. In Dutch.—ED.]

580. DE SOYZA, D. J. 633.88
The kidney tea plant (*Orthosiphon stamineus* Benth).
Trop. Agriculturist, 1936, 86: 210-4.

The opportunity for the profitable cultivation of this plant is stressed. It is stated to have pronounced therapeutic properties in cases of liver and kidney disorders. At present it is cultivated in Java and Sumatra in large plantations and the entire produce is sent to Germany for the manufacture of patent medicines. Its value seems to be unknown in Empire countries. The plant, which is here botanically described at some length, is a perennial herb, native of the East Indies. It is easily grown under thin shade in a rich, somewhat moist soil, though it stands drought well. Clay soil is unsuitable. Propagation is by cuttings of mature stems 6 inches long and having two nodes, rooted in the nursery or the field. After care consists chiefly in the maintenance of a surface mulch between the rows. The first pluckings can be made in a few months, the shoot tips being picked off as in the case of tea down to the 4th leaf. The process can be repeated every 2 or 3 weeks. Curing is done by withering on frames under a well-ventilated cover for 24 hours and then slowly drying either by sun or artificially. Quick drying destroys the active principles of the drug. The dried product is then passed through a 3 mm. mesh sieve and packed for export in airtight tins. 6 lb. of green leaf produce 1 lb. of cured tea.

581. MURRAY, R. K. S. 633.912 : 631.536
The case for replanting.
Quart. Circ. Rubber Research Scheme, 1935, 12: 54-64.

The economic advantages of replanting estates yielding about 400 lb. per acre with high yielding clonal rubber (or high yielding seedlings if available) is pointed out. Clonal material can now be procured which should produce from 800-1,000 lb. per acre in about 9-10 years with a progressive increase as the trees grow to maturity. Under the present international restriction scheme $\frac{1}{3}$ of an estate can be replanted in 4 years. Attempts to improve existing rubber by improved cultivation methods are uneconomic. Many of the trees are inherently low yielding and will fail to respond adequately to any treatment, and such response as may occur would with old trees in any case be slow. Doubts as to whether young trees will grow satisfactorily on exhausted and eroded rubber lands are reasonable. Such failures as have occurred in the past, however, can be shown to be due to lack of cultural attention. Soils of this nature can be quickly restored to fertility by the intensive growth and utilization of green manure plants. Planting under existing rubber with a view to the subsequent elimination of the old trees is definitely unsatisfactory and new plantations should be made on cleared lands. The new

plantations should have an easily negotiated road system in view of the very large increase in latex to be transported. The financial aspect is considered. The author asserts that, even if over production results from improved plantings, the high yielding, efficient estate will always beat the low yielding one when dividends are distributed. The uses to which rubber will be applied will largely increase and the time is foreseen when double and treble the present crop will be produced and absorbed profitably, though at a low price. It is the modernized, high yielding estate which will then gain the advantage.

582. BEELEY, F. 632.42 : 633.912
The F.M.S. Government scheme for the testing and approval of fungicides for the treatment of mouldy rot on rubber tree.
Malay. agric. J., 1936, 24 : 257-67.

Mouldy rot (*Ceratostomella fimbriata*) attacks the tapping panel of rubber trees. The exposed cambial tissues at the tapping point are equally or more sensitive to contact with most fungicides containing dissolved mineral salts and to tar acid mixtures used in the preservation of timbers when applied undiluted than the fungi which these preparations are intended to control. However, emulsified weaker mixtures had some success and proprietary preparations for controlling the disease appeared on the market. It soon became evident that tests should be undertaken to provide an approved list of standard disinfectants for this disease. Accordingly a scheme of field and laboratory tests was drawn up and the methods to be used are described in this paper. Manufacturers whose voluntarily submitted preparations pass the test will have them included in future recommendations on control by the Department, provided a guarantee is given that the formula will not be changed without notification to the Director of Agriculture.

583. KOSURUKOW, N. 633.913
Cultural methods for "taou-sagiz" (*Scorzonera taou-sagiz* Leph and Bosse).
 [Russian-English summary.]

Agricultural Science in Kasakstan, 1935, No. 1 and 2, pp. 55-60, 130-1.
 A description of the cultivation of *Scorzonera taou-sagiz*, now being grown in Soviet Russia as a rubber yielding plant. [An account of the Soviet's rubber growing plans appeared in *India-Rubber J., 1932, 83 : 9 : 10, H.A., 1932, 2 : 2 : 185.*] The optimum depth of sowing in autumn is 1 cm., in spring a difference of from 1-3 cm. is immaterial. Sowing on the ridges gives a slightly better germination than on the flat. After germination seedlings are liable to die off in patches, the cause being at present under investigation. Sowing at the rate of 6-7 kg. per hectare will largely neutralize this. The amount of irrigation necessary has not been determined properly owing to the intervention of rain, but it is known that a plentiful supply of water is beneficial to young plants and accelerates their growth. To secure winter survival of young plants sowing should be done early in the autumn. Cutting the roots resulted in the production of several vigorous roots to take their place, and the plants so treated proved harder than the untreated.

584. CHEEMA, G. S. 634.1/8
Recent progress in fruit growing in India and abroad.
Agric. Live-Stk. India, 1935, 5 : 473-9.

A popular article reviewing in a general way the methods adopted by various countries including India to improve their fruit production for home consumption and export.

585. *Kheswalla, K. F. 634.1/8-2.4
Fruit diseases in Baluchistan.
Agric. Live-Stk., India, 1936, 6 : 204-15, bibl. 11.

The fruit tree diseases recorded are those found on two visits of inspection during the rains in 1932 and 1933. The climate is dry and cool, the elevation being 5,500 ft. above sea level. Temperatures range from 105° F. in summer to below freezing point in winter. Dry, hot winds are troublesome. Wind breaks and cover crops to shade the ground are necessary. The control

measures given are those found useful in other parts of India. *Apples and pears.* 1. Blister disease (*Coniothecium chomatosporum* Corda) produces cracks and russetting on apples, and is controlled by lime-sulphur spray at summer strength just after petal fall and again 3 weeks later. 2. Soft rot or blue mould of apples (*Penicillium expansum* Thom). Light coloured soft spots on the fruit increasing in size till the whole is decayed. Infection is through wounds. Discarding all injured fruit and careful handling will reduce the incidence. 3. Pink rot of apples (*Trichothecium roseum* Link). A white woolly growth on apples, turning pink as the spores develop, enters through wounds, is controlled by care in picking. Piling picked apples creates a favourable environment and should be avoided. 4. *Alternaria* rot of apples. Brownish-green mycelium and spores. Enters through wounds, and is avoided by rejection of all damaged apples in storage. 5. Jonathan spot on apples. Superficial black spots, chiefly affecting appearance, of physiological origin. 6. Leaf scorch of apples and pears. Due to soil deficiencies, or to spring frosts following a hot wet summer of the previous year, when the trees have transpired too freely. 7. Stem canker of apples (*Cytospora* sp.). Found only on some trees imported from England and California in 1933. 8. *Oidium* mildew, a greyish-felt-like covering on the leaves, controlled by lime-sulphur 1 gallon added to 50 gallons water containing 3 lb. iron sulphate, applied before blossom, after petal fall, and again a month later. 9. Die back of pear. The reason for the dying back of branches and twigs is uncertain, but is probably physiological. *Stone fruits.* 1. Peach leaf curl (*Taphrina deformans* (Berk) (Tull)), a fungus disease controlled by burgundy mixture $3\frac{1}{2}$ lb.-4 lb.-18 gall. water + $4\frac{1}{2}$ pints of milk as a sticker, applied just before the buds swell. Affected shoots and leaves are removed. 2. Peach scab or freckles (*Cladosporium carpophilum* Thuem). Circular, dark, olivaceous lesions on the fruit. Controlled by self-boiled lime-sulphurs 8-8-50, applied 4 or 5 weeks after petal drop and again 2-4 weeks later. Infected twigs in which the fungus overwinters should be removed. 3. Splitting in peach fruit, a characteristic being the splitting of the stone into halves. Probably physiological. 4. Gummosis. Gum exudes from the tree. The cause is vigorous growth and an over-wet soil, particularly if accompanied by excessive nitrogenous manuring. Control measures (1) reduction of one of these factors, (2) root pruning, (3) application of lime or common salt. 5. Peach yellows (suspected). A virus disease producing abnormality in development of young twigs and shoots and fruit. This was observed in twigs or shoots, but the characteristic symptoms of the disease on the actual fruits were not found. 6. *Alternaria* leaf-spot of peach. Pâle brown circles surrounded by a dark brown outer ring. Control measures are unnecessary at present. 7. *Coniothecium* leaf-spot of peaches. Irregular dark brown spots coalescing to form large, irregular, discoloured areas. Control not yet necessary. 8. Peach rot (*Rhizopus nigricans* Ehrenberg). White cottony felt changing to black appears on mature fruits usually in storage. Careful handling and the avoidance of over-ripe fruit at picking will minimize the risk. 9. Shot-hole of almond, apricot and peach (*Phyllosticta prunicola* Sacc.). Small, brown, irregular spots on the leaves, uniting if numerous, becoming brittle and falling away, leaving holes in the leaves. Fungus winters on fallen leaves which should be dug in or burnt. 10. *Alternaria* leaf-spot of almond. Differs little from the form (6) causing leaf-spot of peach. Is unimportant. 11. Mildew on almond leaves (*Oidioopsis taurica* Salmon). Attacks under-sides of almond leaves forming a felt-like covering. The foliage becomes pale yellow. A scarce disease here. 12. *Cytospora* die back of almond. Affected limbs die back and turn chalky white, the black pycnidia of the fungus appearing as small specks over the white area. The bark flakes off and defoliation occurs. Affected parts should be cut out. 13. *Cytospora* die back of walnut. The mycelium is light orange and affected branches turn a dark tan colour. The pycnidia are larger than in the *Cytospora* which causes die back of almonds. Dead twigs and branches lying in the orchard should be removed, as the fungus can maintain itself indefinitely on them and they prove a source of infection. *Miscellaneous fruits.* 1. Powdery mildew of grapes (*Uncinula necator* (Schw) (Burr)). Only the fruits were found to be attacked in Baluchistan and only the *Oidium* stage of the fungus was found. Greenish-white patches appear on the fruits, which develop irregularly and crack. Dry weather following rain causes severe infestations. Finely powdered sulphur applied when shoots are 6-8 inches long, before blossoming, and a month later, with a fourth application to

late varieties is effective. 2. *Clasterosporium* sp. on vine leaves. A mild fungus disease forming dark velvety irregular spots 1-8 mm. in diameter on the under surface of the leaf. 3. Sooty mould on fig. A fungus (*Capnodium* sp.) developing on the honeydew secretion of aphides. Any damage is done by shutting off the light from the leaves. 4. Fruit rot of water melon. Dark bluish discolouration on the rind, the pulp between becoming soft. The spores of this fungus (*Pythium aphanidermatum* (Eds.) Fitz) remain viable in the soil for a long time and are liable to attack fruit resting thereon. 5. Internal rot of pomegranate. A fungus (*Aspergillus castaneus* Patt) attacking the seeds. A central cavity filled with the dark brown spores is formed in the fruit. Apparently whole or injured fruits may be attacked. In the former case entry is probably obtained through the calyx end of insect punctures. Excellent photographic illustrations, some coloured, are given of each disease.

586. STEPHENS, S. E. 634.412

Some tropical fruits. 9. The sugar apple.

Qd. agric. J., 1936, 46 : 100-1.

Anona squamosa, the sugar apple, is an introduced fruit to Queensland where it flourishes particularly well in the black sand along the foreshore of the Cardwell district. It grows and fruits well in other districts also, but less vigorously. Propagation in Queensland appears to be by seeds which are generally numerous, though there are individual trees whose fruits contain only a few. Flavour and yield also vary with individuals, so that the case for selection of propagating material is clear. The tree is deciduous or semi-deciduous and the fruit is borne on the current season's growth as well as on the older wood. Maturity of fruit is gauged by the opening and lightening in colour of the interstices between the scales of the yellowish-green skin. At this point it is picked and stored for 2 or 3 days before consumption. Fruiting begins when the tree is 3 or 4 years old. Pruning in the early stages is directed to forming the tree; once the framework is established, it consists chiefly in thinning and shortening back to prevent overcrowding. Pruning should not be started in spring until the sap is running and the buds begin to swell, or the tree may die.

587. JOHNSON, A. M. 634.42 : 581.141

Polyembryony in *Eugenia Hookeri*.

Amer. J. Bot., 1936, 23 : 83-8.

Seeds of *Eugenia Hookeri* were found in all cases to be polyembryonic, the number of embryos per seed ranging from 2 to 21, and the commonest numbers being 15, 10 and 6. The various arrangements of these embryos are described with the aid of numerous diagrams. No similar condition could be found in the smaller seeds of other species of *Eugenia* available for study.

588. HARTLEY, B. J. 634.58

Groundnuts and their cultivation.

E. Afr. agric. J., 1936, 1 : 501-11, bibl. 12.

Instructions are given for the cultivation of groundnuts in Tanganyika. The variety advised is Virginia Bunch, a drought resistant introduction from South Africa which can be farmed by machinery. Two other types are Kalande Runner grown for stock feed, which includes haulm as well as nuts, and Manyema Bunch, a medium early type easy to shell. At present produce buyers purchase the kernels of all at the same price and mix them. The bunch types, however, have a higher oil content and with large scale production should command a better price.

589. BUNTING, B. AND MARSH, T. D. 632.954 : 634.6

Effect of sodium chlorate used as a weed killer among oil palms.

Malay agric. J., 1936, 24 : 22-5.

The experiments were carried out at the Central Experiment Station, Serdang, on 4 acres of ten-year-old palms, somewhat lacking in vigour owing to the presence of hard pan 2 ft. below

the surface. There were 2 clean and 2 unweeded plots. Two applications of sodium chlorate at an interval of one month applied up to a rate of 8 lb. in 32 gallons of water per acre had no ill effects on mature or younger oil palms. The grass was browned but ferns were not seriously damaged. Two further dressings at the rate of 14 lb. in 25 gallons of water per acre had no ill effect on the palms. The ferns and weeds had re-established themselves on both clean and unweeded plots by the end of the experiment.

590. THOMPSON, A.

634.6-2.42

Ustulina zonata* on the oil palm.Malay. agric. J.*, 1936, 24 : 222-6, bibl. 2.

This fungus is a parasite of rubber, tea, coffee, and other trees, but hitherto had not been observed on oil palms. Recently, however, it has been occasionally found in association with a root disease and as a potential wound parasite on the stems of oil palms being referred to as "charcoal base rot". Actual penetration into the stem tissue by way of the leaf bases above ground has not yet been observed. A single attempt to infect a healthy palm by burying infected tissue near the roots failed. It is, however, not advisable to dispose of palm tissue affected by *Ustulina* by burying in the vicinity of oil palms, although this is the usual and safe manner of treating palms killed by stem rot (*Fomes noxius*). Further investigations are being carried out by the Department of Agriculture.

591. COOK, O. F.

634.6

Royal palms in upper Florida.*Science*, 1936, 84 : 60-1, bibl. in text.

A popular account is given of the royal palm, *Roystonea floridana*, which is native to Florida. Once widespread, this magnificent palm is now found only in limited numbers in a few areas, and the author makes a plea that wild seedlings scattered by birds should be recognized and protected. When grown in favourable places the young palms may attain a height of 20 feet within 6 years from sowing. Transplanting at 2-3 years requires great care to avoid root injuries and setbacks which may result in death or permanent disfigurement. The dried fruits, which have been found in Cuba to contain up to 18% oil, are valued for cattle, pigs or poultry, and the trees themselves are useful for sheltering gardens and orchards against trade-winds and hurricanes. In severe storms the foliage is shed, leaving the terminal bud wrapped in the leaf-sheaths, but the rigid trunk remains standing.

592. GRASOVSKY, A.

634.62

Possibilities of date culture in Palestine. [Hebrew.]*Boustnai*, 1935, 7 : 33 : 20-2, bibl. 5.

The decline of date growing in Palestine is discussed. The import of dates into Palestine in 1934 amounted to 335,000 kilos. of fresh and 3,256,000 kilos. of dried dates. These dates could easily have been grown in the country. Much land unsuitable for citrus and now largely lying waste could grow dates well, and a list of such areas is given. Trial plots should be established in each. A list of date varieties for both fresh and dry date production most suitable for each area is given with reasons for selection. Obtaining propagating material of the better varieties will be difficult, since nearly every nearby country growing them has forbidden the export of offshoots. The U.S.A. is the most probable source, but expense (£1 per offshoot) and the very high percentage of loss are deterrent. The cost might be lessened, if larger numbers could be imported and the difficulties of propagation overcome. The latter has been successfully dealt with in America, and the remainder of the article consists of an enumeration of the many points to be observed, if successful propagation on a commercial scale is to be attained. [Full translation available.]

593. CHEEMA, G. S. AND BHAT, S. S. 634.771-1.523
Banana breeding at the Imperial College of Tropical Agriculture, Trinidad.

Indian J. agric. Sci., 1936, 6 : 484-501, bibl. 30.

This consists of a summary of the work of Cheesman and Harter reported in the *Empire Marketing Board's Report* of December, 1931, and the *Journal of Genetics*, 1932, 26 : 261-316 and 30 : 31-52. Abstracts of these reports will be found in *H.A.*, 1932, 2 : 1 : 85, 1933, 3 : 2 : 254, 1935, 5 : 4 : 726.

594. TAM, R. K. AND MAGISTAD, O. C. 634.774-1.874
Chemical changes during decomposition of pineapple trash under field conditions.

Soil Sci., 1936, 41 : 315-27, bibl. 18, being *Tech. Pap.*, 87, of *Pineapple Exp. Sta., Hawaii.*

After 35 weeks of decomposition, during which the necessary moisture was supplied by heavy rainfall, the residual leaf material of the trash was only 9% of the original, and of the stumps 19% remained undecomposed. Water-soluble reducing sugars had almost disappeared after 7 weeks. Crude protein increased during decomposition, whereas water soluble nitrogen decreased; during the last 12 weeks this process was reversed. The C/N ratio of the soil was increased from 4.8 : 1 to 10.8 : 1 by the incorporation of 27 tons of trash, but dropped to 5.9 : 1 after 35 weeks. Available nitrogen in soils in which the trash had been incorporated decreased during the first 23 weeks but increased during the last 12 weeks. Replaceable potassium in the soil increased from 350 to 1,160 lb. per acre foot of soil on the basis of 2,400,000 lb. of soil per acre foot. Potassium fertilization of soils containing half the amount of the increase would probably obtain no response from the pineapple plants. Soluble phosphorus declined at first but subsequently regained its former level in the soil.

STORAGE.

595. PAINTER, A. C. 664.85.035.1
Some notes on one year's experience with a gas store.

Annu. Rep. East Malling Res. Sta. for 1935, A19, 1936, pp. 213-9, bibl. 1.*

The fruit dealt with were apples of the following cooking varieties:—Bramley's Seedling, Lane's Prince Albert and Edward VII. The author summarizes as follows:—1. Some results of a year's experience with a gas store confirmed the findings of other research workers. 2. Where the interval between picking and storing of the fruit was short, the percentage of wastage was low, and there was no great difference in wastage between large and small sized fruit. Where the interval was long, wastage was high with a big difference between large and small fruit. 3. Marked differences were observed in the keeping qualities of fruit from different plantations. 4. A preliminary test on fruit packed ready for market indicated that it would be unwise to attempt to store fruit in that way unless it is first of all carefully picked and graded and then stored under the best conditions. 5. Bramley's from a grass plot were put over a Cutler grader after storage without detracting in any way from their commercial value. 6. Arising out of the above a number of recommendations are made as to precautions to be taken when gas storing fruit. 7. An estimate of the cost of gas storage is given.

596. DELONG, W. A. 634.11-2.19
Variations in the chief ash constituents of apples affected with blotchy cork.

Plant Physiol., 1936, 11 : 453-6, bibl. 5.

The ash of blotchy cork affected fruit collected from Fallawater apple trees in various localities in Nova Scotia was compared with that of fruit from nearby, susceptible but unaffected trees and from distant trees of known history which had never been affected. The soil types were

* Viz. Kidd, F. and West, C. The refrigerated gas storage of apples. *Food Investigation Leaflet* 6, 1935 [limited number of copies available from Bureau—Ed.], *H.A.*, 1935, 5 : 3 : 497.

similar, ranging from sandy loam to a gravelly soil. The most striking deviation in inorganic composition between affected fruit and unaffected fruit of both classes was in a pronounced diminution of the calcium content in proportion to the severity of the disorder. While the cause of this deficiency of calcium is uncertain, it is suggested that it may arise as a result of competition between leafy shoot and fruit tissues during early stages of growth. It is known that blotchy cork appears commonly on over-vegetative trees, and that as between leaves and fruit some 90% of the calcium is found in the leaves. Further unpublished data are available which indicate that calcium is being absorbed by the growing fruit coincidentally with the most rapid production of new shoots and leaves by the tree. The fact that boron is reported to be associated in some way with the calcium nutrition of plants and that the amelioration of cork symptoms on fruit has been obtained after treatment with boric acid is noted.

597. OPPENHEIM, J. D.

664.85.3 : 632.4

Fruit wastage during transport.*Hadar, 1936, 9 : 101-2.*

An indictment of the present method of shipping oranges and a plea for a thorough investigation. The reasons for the wastage of Palestine citrus during transport are investigated. The factors are (1) those depending on picking, selecting, packing, etc. : (2) unsuitable transport conditions. It was shown by experiment that even fruit which had been roughly treated under (1) still exhibited very little wastage after 6 weeks when properly stored, whereas fruit in perfect condition had become entirely rotten in the same period when stored in a temperature of 28-32° C. with a relative humidity of 80-90%. These unsuitable conditions prevail in loading. When the stacked cases await transfer to the ship, the inner cases of the stack have been found to be quite unventilated in spite of the air passages left between the stacks. In addition cases unloaded from railway trucks are often left exposed to the weather before removal to the transit sheds, and again while loading on board, and are often wetted right through by rain; there is careless handling throughout by unskilled labour and further injury is caused by the pressure of the tackle ropes on the cases. Although particular care has been taken to store the cases on their heads during motor or rail transport, they are laid on their sides in the ship's hold and are often stacked 18 layers high, so that the fruit in the lower cases is not only pressed out of shape by the weight but suffers a physiological change in the properties of the rind as a result. The height of the stacks compels the stevedores to throw the upper cases into position which results in breakage. Ventilation is badly arranged and temperatures are too high. Onions and cotton seed affect the fruit adversely, yet these are often loaded in close proximity. In some boats the water from the bottom of the hold frequently containing dead rats and other horrors washes up through the too widely spaced floor planks, wetting the lower layers of the boxes. A ventilation system suitable to the various climatic zones traversed by the boat is needed. When this has been found and the factors causing fruit rots definitely determined certain standards must be established and their maintenance legally enforced.

598. TOMKINS, R. G.

664.85.3 : 632.4

Citrus fruit wastage.*Hadar, 1936, 9 : 104-5.*

A memorandum presented to the Citrus Fruit Committee of Palestine. Most of the wastage of Palestine citrus in transport is due to green mould, which attacks only injured fruit, though the wound may be minute. Jaffa oranges picked towards the end of the season are more susceptible than those picked earlier, though the liability to attack of any sample cannot be measured. The number of days which rot of stored fruit takes to develop depends on temperature, from 30 days at 5° C. to 3 days at 25° C. These are minimum times, and for practical purposes it is best to consider how long it will take for 10% of the fruit to rot. This may be from 3 to 6 times as long. In any case delay in transport should be avoided, since the amount of wastage incurred is roughly proportional to the sum of the days between picking and arrival at the market. Reasons for delay and damage are analysed. The influence of ventilation

on the extent of waste is uncertain. It removes carbon dioxide and volatile products and reduces the humidity of the air. The effect of these on the extent of rotting is unknown, but given appropriate equipment it could easily be discovered.

599. BROOKS, C.

664.85.323 : 632.1/4

Some storage diseases of grapefruit.

J. agric. Res., 1936, 52 : 319-51, bibl. 13.

Descriptions are given of the following storage diseases of grapefruit:—pitting, oleocellosis, scald, browning of oil glands, watery-breakdown. Pitting may be "definite" or "mild", and the former may appear without passing through the mild stage. Though bacteria were readily isolated from pitted tissue and were found capable of producing pits when inoculated into fruits, modifying factors indicate that the origin of pitting is not primarily bacterial. Low humidity increased both forms of pitting. Definite pitting was much more serious with fruit held at 36° F. and 40° F. than at 32° F., while mild pitting was somewhat worse at 32° F. At 50° F. neither form of pitting appeared. At 30° F. and 32° F. scald and watery breakdown were worse than at 36° F. and 40° F. Holding fruit at 60° F. to 75° F. before storing at 36° F. decreased pitting, but holding at 50° F. was ineffectual. Holding for 17-22 hours at 100° F. greatly decreased pitting in subsequent storage at 36° F. or 40° F., but increased it at 32° F. Scald bordering on watery breakdown was definitely increased particularly at 32° F. by this pre-storage heating. Physiological disorders were practically eliminated by removing fruit to 50° F. permanently after 1 or 2 weeks in the lower temperatures. Pitting was decreased by exposure for 20-48 hours before low temperature storage to atmospheres containing 20-45 per cent. carbon dioxide. Better results were obtained with the longer treatments and higher percentages of gas. Good results were obtained by storing the fruit in paraffin or cellophane wrappers and better still in excessively oiled wrappers. The best control of all was obtained by coating the fruit with mixtures of mineral oils and wax, but this sometimes increased scald and watery breakdown. Stem end rot was frequent at 50° F. but non-existent at 40° F. after 8 weeks.

600. ELMER, O. H.

633.491 : 632.184 : 634.11

Growth inhibition in the potato caused by a gas emanating from apples.

J. agric. Res., 1936, 52 : 609-26, bibl. 9.

A volatile substance, normally produced by the mesocarp and endocarp of sound ripe apple fruits, causes striking morphological and physiological abnormalities in potatoes. Seed pieces planted in moist soil, sawdust, or sphagnum moss, together with a few apples, when placed in a closed container made sprout growth which developed radially approximately as fast as longitudinally and resulted in tuber-like structures. Green plants were also affected. Epinasty occurred in the leaves, and apical growth ceased, but radial enlargement in the younger portions of the stem and in the leaf petioles was marked. Changes found in the normal physiological processes of sprouting potatoes after subjection to the volatile substance included approximate doubling of respiration and catalase activity, an increase in oxidase activity, and an alteration in the nitrogen-carbohydrate balance of sprouts and tubers. In stored dormant potatoes, kept with a sufficient number of apples in partially ventilated boxes, sprouting was practically inhibited, and the total sugar content of the tubers was increased, giving them a sweet flavour. Tests with seed pieces indicated, however, that normal sprout emergence and growth was resumed after the potatoes were removed from the presence of the gas. In the experiments a number of different apple varieties were used and also fruits of pear and hawthorn, and the results show that they all emanate the same growth-inhibiting gas. This gas is oxidized at high temperatures and with potassium permanganate. It is absorbed by bromine, fuming sulphuric acid and chlorosulphonic acid, and analysis of the absorption products obtained by treatment with fuming sulphuric acid indicates that ethylene is produced by these fruits. No distinction could be made between the effects of ethylene and the growth-inhibiting gas from apples on sprout development and the green portions of the potato plant.

601. MINSTER, J. T. 633.491 : 634.11

The effect of apples on potato sprouting.

Food Manuf., 1936, 11 : 67-8, bibl. 1.

A practical instance of the supposed inhibitory influence of maleic acid on the sprouting of potatoes is given. Two cardboard boxes, $22 \times 16 \times 10$ cm., were each filled with 5 lb. of evenly graded Kerr's Pink potato on December 20th (68 potatoes each). The potatoes were then showing pin point shoots. At the bottom of one box an apple was placed. The 2 boxes of potatoes were lidded, wrapped with brown paper, and stored in an unheated brick building until March 20th when shoot growth was measured. The ratio of total shoot lengths in the control box to shoot lengths in the box containing the apple, viz. 2.51 : 1, clearly indicates the effect of the apple, which might have been even greater, if the experiment had been started earlier. The apple (variety unknown) had become brown, soft and slightly mouldy, but not wet or pulpy. No difference in the culinary properties of the two lots was found.

PACKING, PROCESSING AND FRUIT PRODUCTS.

602. DREYER, D. J. 664.85.13

The damage to pears packed in cases.

Food Manuf., 1936, 11 : 56-8, 93-5, bibl. 4.

A paper presented at the Imperial Botanical Conference, London, 1935. As the supply of the luxury pack, single layer trays of South African pears began to exceed the demand, recourse was had to packing in cases as was done by California. The Californian case of $18 \times 11\frac{1}{2} \times 8\frac{1}{2}$ in. was eventually adopted owing to complications caused by a South African bushel case originally used being 2 inches deeper though holding the same amount of fruit (42.46 lb.). In spite of its larger size the South African case used to be passed over by fruit buyers in preference for the Californian, which though shallower showed a bigger bulge, thus appearing fuller. Since a wide range of counts enables the grower to control the tightness of the pack, tests were made to discover the relationship, if any, between the tightness of the pack and the keeping quality of the fruit. It was found that the tighter the pack, the greater the amount of bruising, but the less the damage from rough handling in transit. Degrees and types of bruising were classified as severe or slight and box bruised or fruit bruised, according to whether the box wood or the adjacent fruit caused the injury. The light yellow-skinned varieties show bruising much more conspicuously externally than the green-skinned. Unbruised fruit kept from 33-50 per cent. better than bruised fruit. An experimental consignment shipped to England consisting of 300 cases containing 8 varieties showed after 18 days 24% severe bruising and 4% waste. The bruised fruit had, naturally, a reduced sales value. 1, 2 and 4 layer packages were tested for extent of injury in relation to tightness of pack. Taking the nett weight of fruit and the capacity of the container as a basis of comparison (because each class of container showed slight size differences among its individuals) the degree of tightness of pack is expressed as the number of cubic inches of box space into which 1 lb. of fruit is packed. A series of results is tabulated of which the extremes are:—2 layer half boxes packed to 54.6 cu. in. of box space per 1 lb. of fruit resulted in 91.9 per cent. of sound fruit, packed to 48.1 cu. in. in 83.1 per cent., 4 layer cases packed to 46.3 cu. in. gave 64.9 per cent. and to 40.8 cu. in. 40.1 per cent., while 1 layer trays were packed to 67.8 cu. in. and gave 96.5 sound fruit. In the 4 layer cases bruising was highest in the two outer layers, but wastage due to moulds and core-breakdown was more prevalent and persistent in fruit from the centre layers, even though this was removed from the cases while semi-green and kept in single layers on ripening trays. Pressure tests showed that the centre fruits were actually appreciably less ripe than the outer fruits, thus this increased wastage of centre fruits cannot be due to hastened maturity. Suggestions are made for the reduction of bruising, such as the use of wood wool pads or corrugated cardboard lining combined with a medium tightness of pack. The bulge pack should be discontinued. The reduction

of breakdown in inner rows might be reduced by packing the centre pears in oiled paper, or using a centre layer of wood wool which might absorb moisture and possibly the volatile products of metabolism. The matter should be a subject for experiment. Some of the thinner skinned varieties should never be packed in cases.

603. JOACHIM, A. W. R.

634.573-1.56

The curing of cashew nuts for export.*Trop. Agriculturist, 1936, 87 : 22-5.*

The methods of curing the cashew nuts for export in Southern India have been studied with a view to their modification or improvement in Ceylon. The removal of the pericarp or shell requires a previous slight roasting to eliminate the caustic oil it contains and to render the nuts brittle. In S. India this is done in open iron pans over small earthenware furnaces fed by the rinds of previously shelled nuts. The period of roasting is one minute, great care being taken not to brown the nuts and so render them unfit for export. The smell from these factories is so unpleasant that they have to be situated away from residential districts. Roasting in electrically heated ovens at different temperatures showed that below 100° F. the shells remained tough and at 120° F. showed browning. A machine roaster from S. India discoloured more nuts than the open pan method. A chimney to remove the gases by suction might be successful but would be expensive. The highly skilled process of shelling is the next operation. This is done by women and boys, the shell being cracked with a wooden mallet, and the kernel removed with a wire prong. The reddish-brown inner seed coat has also to be removed. This is done in India by spreading the nuts on wire gauze trays in hot air rooms at 120° F. for 3 hours, the seed coat being removed by this drying. In Ceylon 155° F. was found more suitable. At higher temperatures than this the kernels become brittle. The tendency for the gauze to mark the kernels could be avoided by the use of a textile fabric. On removal from the hot air chamber the nuts are peeled by hand, then spread on the floor where they absorb some moisture and become less brittle. Grades of kernels are (1) wholes, (2) halves, of one cotyledon only, (3) broken, and (4) rejects or spoils. Only wholes and halves are exported, the latter fetching a much lower price. The dried and graded nuts are packed in 25 lb. tins which are subsequently vacuumized through a small hole in the lid, the former practice of charging the tins with carbon dioxide gas being objected to by importers. Nuts packed by either method will keep for at least two years, and if merely packed in hermetically sealed tins for at least one year. By-products might have some local use. Rind oil can be obtained by heating the kernels to 120° C. or higher for 3 hours. Ways of doing this are described. The oil is used as wood-paint for treating fishing nets and has been used in the manufacture of bakelite. Its value, however, commercially is so much less than that of the kernels that it is not profitable to extract it. The chief constituents are anacardic acid, gallic acid and cardol. The testa or seed coats and the broken kernel tips form a poultry food of high nutritive value, analysis showing the following percentages : water 8.1, proteins 7.6, fat 12.3, carbohydrates 59.2, fibre 11.0, ash 1.8. A gum produced from incisions in the tree is reported to be insect proof and could be used in bookbinding. A fermented spirit can be prepared from the juice of the pedicels. The juice contains 8-12 per cent. of reducing sugars and has anti-scorbutic properties.

604. CHARLEY, V. L. S.

663.813

Investigations on fruit products. V. The concentration of fruit juices by freezing with special reference to apple juice.*Annu. Rep. Long Ashton Res. Sta. for 1935, 1936, pp. 150-61, bibl. 5.*

1. Concentrated apple juices have been produced by means of freezing and subsequent removal of ice. Sugar contents in the concentrates have ranged between 45% and 55%. 2. The flavour of concentrates produced in this manner has been shown to be more attractive than that of vacuum evaporated samples. 3. Three ciders have been concentrated by the cold process. The alcohol contents have been nearly doubled by this means. [Author's summary.]

605. CHARLEY, V. L. S. 663.813
Investigations on fruit products. VI. Fruit syrups. A. Production of fruit syrups. B. Use of pure fruit syrups in milk beverages.
Annu. Rep. Long Ashton Res. Sta. for 1935, 1936, pp. 162-73 and 174-83, bibl. 6.

The work at Long Ashton on fruit products is gradually evolving a new and satisfactory use for such common fruits as strawberries, loganberries, black currants and red and white gooseberries. The progress made and results achieved to date are here recorded.

606. CHARLEY, V. L. S. 663.813
Investigations on fruit products. VII. Production of fruit squashes. Progress report.
Annu. Rep. Long Ashton Res. Sta. for 1935, 1936, pp. 184-91.

Experiments show that progress has been made towards the successful preparation of squashes from berry fruit. Experiments included strawberries, raspberries, black currants and loganberries. The flavours of most of the squashes made were good, but in order to give the products a more pleasant appearance, further investigation is necessary.

607. CHARLEY, V. L. S. 663.3
Investigations on fruit products. VIII. Production of fruit wines.
Annu. Rep. Long Ashton Res. Sta. for 1935, 1936, pp. 192-216, bibl. 1.

This report is divided into 3 sections. In the first the author deals with the effects of dilution of the juice and the addition of press cake to strawberry, gooseberry, loganberry and raspberry wines. Attractive wines were made in each series. In the second section he discusses the effect of different types of sugar and yeast* in the making of raspberry wine. In the third section he deals with the question of yeast nutrition in fruit wines, which has hitherto been a problem in the manufacture of these berry wines resulting in incomplete fermentation. Nitrogen, phosphorus, calcium, magnesium, potassium and sulphur are elements necessary for the active development of yeast cells. Hence the experiment was made of adding these in various forms and the results on the wines were noted. Nitrogenous nutrients were found to extend fermentation most, whereas calcium and magnesium salts inhibited it slightly. The addition of these inorganic substances exerted little deleterious effect on flavour, unlike that of meat juice, which was definitely detrimental to it.

608. CHARLEY, V. L. S. 663.3
Low temperature keeving of cider.

Annu. Rep. Long Ashton Res. Sta. for 1935, 1936, pp. 138-44, bibl. 1.

The practice of keeving consists in allowing fresh juice to stand in large open vats or casks for several days at a low temperature. The formation of a brown head, indicating that an appreciable separation of solid tissue is being effected is followed by a careful racking to leave the brown head and the bottom deposit undisturbed. Properly keeved juices are practically clear and devoid of many compounds likely to come out of solution later and cause haze or deposits. Although the practice has gone out in this country as the result of radical changes in cider manufacturing processes, it is carried out on a large scale in France. Observations were made in the Long Ashton trials of the early effects of keeving samples of comparable apple juice at two temperatures, namely 9° C. and 2° C. for 1 week. The juices stored at the lower temperature were considerably clearer than the others, especially in the case of a mixed culinary apple juice. The juices stored at the lower temperature, moreover, retained more pectin. The possible effect of nitrogenous materials on the clearing of juices is discussed. The

* i.e. pure cultures from various types of well-known European grape wine.

most marked clarification occurred in juice from market varieties of apple which had also initially contained the most pectin. Keeving at 2° C. temporarily retarded subsequent fermentation. No significant differences were noted in the condition or flavour of the ciders.

609. BANERJEE, B. N. AND RANGA RAO, N. K. 631.56 : 634.31 + 634.337
Utilization of oranges and limes.

Agric. Live-Stk. India, 1936, 6 : 139-53, bibl. 29.

Various citrus fruits grown in the Madras Presidency have been tested for their preserving qualities chiefly in the form of juice. Citrus juices require considerable care in their treatment as they spoil easily. The following rules are given as having been found by experiment to give good results. Only the best fruit should be used and at the time when it has the highest sugar content and best flavour. After extraction the juice should be de-aerated, kept from further contact with air, and preferably worked in an atmosphere of an inert gas such as hydrogen, nitrogen or carbon dioxide. All pulp should be removed from the juice and the coagulable fraction in solution removed after precipitation. Not more than 0.005% of terpeneless lemon or orange oil should be used for flavouring. The juice can be flash pasteurized and vacuum sealed, or frozen quickly and stored at -18° C. out of contact with air. Slow thawing of frozen juice is necessary before consumption. Acidity should be maintained at more than 1% and sugar added to make the ratio of acid to sugar from 1 to 7 to 14 per cent. Sulphur dioxide gas or sodium benzoate up to 0.05% can be used as an antiseptic. The juice must not at any time come in contact with iron or copper, but silver, block tin, monel metal, duraloy, aluminium and stainless steel may be used.

610. BECKLEY, V. A. 668.52

Essential oils. II.* Oils from indigenous plants.

E. Afr. agric. J., 1936, 1 : 469-70.

A large number of the indigenous scented plants of Kenya has been distilled during the last 6 years. Only a few have produced oils of marketable value. *Ocimum canum* gives a good yield of oil from which 16-25% of true camphor can be obtained on cooling. At one time it was commercially grown, but production has now ceased. Oil of *Ocimum nakurense* contains 15% eugenol, the main constituent of oil of cloves. The wood of *Brachylaena Hutchinsii* gives from 0.6 to 0.9% of an oil resembling vetivert. This oil fetches 20s. per lb. and a small export trade has developed. *Excoecaria africana* produced 0.6% of a very viscous oil which was difficult to deal with. The wood was then extracted with petroleum ether which produced 10% of scented oleo-resin. It may have some value as a fixative in high-class perfumery. *Cymbopogon afronardus*, "lemon grass", gave a yield of from 0.5-1.0% of clear yellow oil resembling palmarosa oil. A good geraniol may be prepared from this oil. It is pointed out that any attempt to supply these new oils in large quantities before they become established in the market would result in a loss to the grower and a cessation of production.

611. McDONALD, J. A. 633.74-1.56

A new method of curing small quantities of cacao.

Fifth annu. Rep. on Cacao Research for 1935, I.C.T.A., Trinidad, 1936,
 pp. 48-55, bibl. 4.

Fermentation is carried out with the aid of a newly devised solar fermenting frame, which is described. The advantages are that a blanket of warm air at 100° F.-150° F. is maintained round the sweat box for a period of 8 hours a day, excessive evaporation is prevented, the apparatus can be simply and cheaply constructed, and the heat supply costs nothing. The fermented cacao is of excellent and even appearance and quality and almost free from blue mould. Turning the cacao during fermentation becomes unnecessary as an even temperature is maintained throughout the mass.

* Part I dealing with methods of preparation, *Ibidem*, 1936, 1 : 302-4, 308; *H.A.*, 6 : 2 : 419 (3 lines).

NOTES ON BOOKS AND REPORTS.

612. TAYLOR, H. V. 634.11
The apples of England.
 Crosby Lockwood & Co., London, 1936, pp. 266, bibl. 39, 21s.
 In this book, as the preface states, "an attempt has been made to provide available information concerning the varieties of apple grown in England to-day". The list does not claim to be exhaustive, but since the author has succeeded in noting, sometimes in a few lines, sometimes to the extent of half a page or more, nearly 600 varieties, he has at least pointed the keen amateur a goal worth aiming at, though the average garden potterer who "just wants a nice apple tree" may be left feeling a trifle bewildered. The commercial grower, too, chained though he is by his master "The Market" to certain popular outsize and woolly varieties, may well feel an uplift of spirit as a perusal of the pages brings home to him that after all there are some other kinds of apple, 589 of them in fact (at a rough count), and that the author, not content with hearsay, has handled them all. The notes on varieties, which occupy the larger part of the book are prefaced by some interesting chapters. In chapter 1, which discusses the meaning of the term variety as applied to the apple, it is laid down that a separate variety is one that in all environments preserves some distinctive character which distinguishes it readily from all other varieties. In chapter 2, "The life of a variety", the theory of senescence of a variety is discussed. The gradual degeneration or increasing susceptibility to disease in a variety, which some think does occur, may be due, it is shown, not to a senility which is shared by all its scions, but rather to the fact that the longer a variety has been in cultivation the more difficult it is to obtain healthy scions from it. Diseased shoots, inadvertently taken from weaker trees propagate a weaker generation and so a progressive "degeneration" may easily be brought about, until the variety dies out or is discarded. Chapter 3, which is one of the most interesting, containing as it does matter not found in text books, gives an historical sketch of the development of British varieties starting with the Pearmain first recorded in 1204. Chapters 4 and 5 deal with tree and leaf, blossom and fruit characters. Chapter 6 explains the chromosome with brevity and efficiency. Chapter 7 on the uses of the apple discusses the question of flavour, the parts played by individual taste and smell, and the reasons for national preferences which differ with each country for particular kinds of apple. The final chapter gives an account of various classificatory systems of which the most satisfactory, though admittedly still imperfect, is that put forward in Bunyard's History of the classification of apples.

613. MARTIN, H. 632.9
The scientific principles of plant protection, with special reference to chemical control. (2nd ed.)
 Edward Arnold & Co., London, 1936, pp. xii. + 379, bibls., 21s.
 The title of this work is unfortunate if it gives rise to an impression that its contents are so highly technical as to be of interest only to chemists and certain other research workers. On the contrary it is written in such a way that, while losing nothing of its utility and appeal to the scientific investigator, all but a very few passages may be read with interest and profit by any intelligent farmer or horticulturist. The first edition of the work has already firmly established itself as the standard English textbook on the subject of plant protection. The new edition has been revised and largely re-written and presents a comprehensive and detailed account of the science. The author sets his stage by a discussion of the nature and classification of crop pests and of the phenomena of resistance and susceptibility in the light of biological and environmental factors. He next devotes a chapter to biological control of pests and diseases. Then comes the major portion of the book—five chapters on the theory and application of chemical fungicides and insecticides. The remaining chapters deal with a miscellany of topics such as seed disinfection, soil treatment, orchard sanitation and the like. In this new edition, all that is most significant in both old and new research work has been ably reviewed and summarized and is now presented in a well-proportioned whole. Recent advances and developments receive due attention and the main trends of the science of plant protection are broadly indicated.

The very extensive bibliographies attached to each sub-section are invaluable for reference purposes. The book is not entirely free from errors and misprints, but the few that appear are but minor blemishes on a very welcome addition to our bookshelves. The publishers have taken the opportunity to reset the book in a type far more suitable than that of the original edition.

H.S.

614. CHRONICA BOTANICA. 58(058)

Chronica Botanica, 1936, vol. 2, pp. 479.

Editor, Fr. Verdoorn, P. O. Box 8, Leiden, Holland, 15 guilders or Dutch florins.

Chronica Botanica, which describes itself as "an independent annual devoted to all branches of plant science", has issued its second number. The contents include mention or extended reports of those congresses held during 1935 at home or abroad whose proceedings have some bearing on plant science. Among them the International Botanical Congress which took place in Amsterdam is treated very fully, being even enlivened by 2 pages of caricatures and a spirited silhouette of Professor Westerdijk's Company of (female) Botanical Singers in full cry. Professor Westerdijk and her four young ladies, succeeded in inducing more than a thousand botanists to join enthusiastically in community singing, probably, as the Editor remarks, for the first time in history. In view of this unprecedented achievement the silhouettist might really have been a little less meticulous when recording their outlines. The major portion of the annual is taken up with a "review of all branches of plant science for the year 1935". This gives scientific and personal news from research stations and agricultural departments throughout the world and claims to be an exhaustive and up-to-date address list of all relevant Institutions and Societies. This section contains a great deal of useful, if miscellaneous, information. The volume closes with a list of new periodicals and an index both of plant names and persons mentioned in the annual. In connexion with the latter we gratefully record that this time personal names have been provided with their initials.

615. WYE. 63(072) (05)

J.S.E. agric. Coll. Wye, 1936, No. 37, pp. 62, 2s. 6d.

This number contains summaries of the advisory and experimental work done by the different departments during 1935. Among research items touched on briefly are the following:—
Entomology:—control of the strawberry blossom weevil, black currant eelworm, sciarid flies (of mushrooms), hop red spider and *Rhynchites* weevils on fruit. *Mycology*:—investigations on hop downy mildew, apple scab, hop virus diseases, hop sclerotinia "canker", an unidentified disease of hop roots, *Cladosporium* disease of hop cones, mushroom diseases, marsh spot in peas. *Hops*:—breeding and manuring. *Engineering*:—spraying machinery. Articles dealing fully with most of these appear *Ibidem*, No. 38 and are abstracted in this number of *H.A.*.

616. IMPERIAL BUREAU OF FRUIT PRODUCTION.

631.532/541 : 634.1/7 + 635.952.2

Vegetative propagation of tropical and sub-tropical fruits.

Tech. Comm. I.B.F.P. 7, 1936, pp. 67, bibl. 123.

A foreword by Sir Geoffrey Evans is followed by illustrated descriptions of different methods of vegetative propagation by R. J. Garner of the East Malling Research Station. The particular methods recommended or known to be used in the propagation of some 100 individual tropical fruit varieties are detailed by G. St. Clair Feilden. An index of popular and botanical names makes for easy reference.